

30TH SPACE WING SAFETY VANDENBERG AFB CA

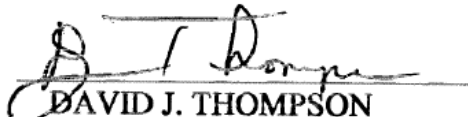
RANGE SAFETY OPERATIONS REQUIREMENTS (RSOR)



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APPROVED:


DAVID J. THOMPSON
Colonel, USAF
30 SW Chief of Safety

OPR: 30 SW/SEO (5-7600)
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TABLE OF CONTENTS

Chapter	Page
1. General	
1.1 Mission	1
1.2 Authority.....	1
1.3 Responsibilities	1
1.4 Administrative	1
1.5 List of Abbreviations	2
2. Operational Concepts	
2.1 Mission Flight Control Terms	7
2.2 Flight Control Mission	8
2.3 Mission Flight Control Requirements Philosophy	8
2.4 Flight Readiness Criteria	10
2.5 Flight Termination Criteria.....	11
2.6 Mission Flight Control System.....	11
3. General Requirements	
3.0 General	15
3.1 Range Tracking Systems	15
3.2 Telemetry.....	16
3.3 Command	16
3.4 Displays	17
3.5 Communications.....	18
3.6 Data Processing	22
3.7 Meteorological.....	22
3.8 Area Clearance	23
3.9 Data Requirements	24
Annexes – Program Specific	
1. Peacekeeper	25
2. Minuteman III.....	41
3. Orbital Suborbital Program Target Launch Vehicle (OSPTLV)	59
4. Ground-based Midcourse Defense Booster Verification.....	73
5. Atlas IIAS	87
6. Delta II.....	103
7. Titan II.....	119
8. Titan IV-B.....	133
9. Pegasus	149
10. Taurus	163

11. Orbital Suborbital Program Space Launch Vehicle (OSPSLV).....	177
12. Delta IV	191

Appendices

A. Launch Area Clearance/Support Locations	A-1
B. Senior MFCO/MFCO Communications Panel.....	B-1
C. Range Safety Weather Launch Commit Criteria	C-1
D. Weather System and Instrumentation Support Plans.....	D-1
E. Flight Safety Project Officer Displays	E-1
F. Mission Specific RSOR Supplements	F-1

CHAPTER 1 - GENERAL

1.1. Mission. In support of Air Force Space Command (AFSPC), the 30th Space Wing (30 SW) conducts or provides oversight for all space and missile launch operations conducted on the Western Range (WR), a Major Range and Test Facility Base (MRTFB). Mission Flight Control Officers (MFCO) execute the flight control operation elements of this mission. The mission element objective is to ensure operations result in acceptable risk to the populace and resources, and do not unduly endanger successful completion of the launch mission.

1.2. Authority. DOD Directive 3200.11, "Major Range and Test Facility Base", and DOD Directive 3230.3, "DOD Support for Commercial Space Launch Activities" assign launch vehicle flight safety responsibility to the commander of each MRTFB. The 30 SW Commander, in Eastern and Western Range (EWR) 127-1, delegates Flight Control Authority for Western Range launch operations to 30 SW/SEO. The Senior Mission Flight Control Officer (SMFCO) and MFCO for each launch operation are Flight Control Authority during the execution phase.

1.3. Responsibilities.

1.3.1. 30 SW/SE. Responsible to the 30 SW Commander for formulating and implementing the Range Safety program. Develops and implements flight safety policy and requirements. Defines safety launch criteria through flight analysis and system engineering.

1.3.2. 30 SW/SEO. Responsible for mission flight control operations on the Western Range. Develops operations requirements, mission rules and launch criteria used to ensure the Range Safety program is effectively executed on launch day.

1.3.3. 30 SW/SEO and 30 RANS/DOO-C SMFCOs and MFCOs. Responsible for developing flight control procedures and executing flight control operations. Responsible for publishing mission specific changes to requirements and mission rules. Evaluates vehicle performance during flight. If required, issues flight termination commands to prevent unacceptable hazards.

1.4. Administrative.

1.4.1. Publication of the Range Safety Operations Requirements (RSOR) is directed by Eastern and Western Range (EWR) 127-1. 30 SW/SEO is the Office of Primary Responsibility (OPR) for the RSOR.

1.4.2. Send requests for changes to 30 SW/SEO. 30 SW/SE will sign all permanent changes and additions to this document. Mission-specific (temporary) changes may be issued by the SMFCO and approved by the 30 SW/SE.

1.4.3. This document replaces the RSOR, dated 1 October 2000, including all revisions and supplements. These requirements will be fully implemented within sixty days of the publication date.

1.4.4. Summary of Changes. This document, although maintaining its previous format, is substantially revised and requires complete review. The following is a summary of major changes: Changed LDCG to LST. Updated FSPO RSTS requirements. Deleted requirement for TIPS FSPO. Deleted MSLS requirements. Removed wording from para 2.3 that linked a no single point of failure requirement to mandatory items. Clarified levels of decision authority in para 2.3.2 for generation and execution phases. Updated TNAR discussion in paras 2.6.2.2 and 2.6.2.3. Standardized local radar tracking requirements. Downgraded site CCT requirement for secure codes. Added Safety Engineering Net requirement. Relocated stripchart TM display requirements to para 5.2. Downgraded AGC and Tone MDI requirements on MFCO stripcharts and RSDS displays. Clarified TM site requirements. Added LST-DCG VDL requirement. Changed IMIB to ISB and updated requirements. Clarified requirements for S&A system. Clarified MLO requirement. Documented Range Communications and Clocks requirements. Updated data delivery requirements. New Delta II 7920 telemetry stripchart requirements. New SLC-2W Program location. New Delta IV requirements. Updated Weather Instrumentation Plans. Updated FSPO display Appendix to include a FSPO display location and requirement summary table.

1.4.5. Distribution. An electronic copy of this document is maintained on the 30 SW/SE web page at http://www.vandenberg.af.mil/30sw/organizations/staff_agencies/safety/index.html. Electronic copy provided upon request for users without access to the Safety web page. Paper copies are not provided.

1.5. List of Abbreviations.

1.5.1. Personnel.

ACO	Aerospace Control Officer
ADSC	Acquisition Data System Controller (ROMSSC)
AFLC	Air Force Launch Conductor
AFLD	Air Force Launch Director
Back Az	Forward Observer
CMD-1	Command System Controller (MFCO "String 1", ROMSSC)
CMD-2	Command System Controller (SMFCO "String 2", ROMSSC)
CSO	Complex Safety Officer (NASA)
DCG	Disaster Control Group [Chief]
DCO	Data Control Officer
FO	Forward Observer (Program or Back Azimuth)
FSA	Flight Safety Analyst
FSPO	Flight Safety Project Officer
ISBP	Interim Safety Board President
LC	Launch Conductor
LD	Launch Director
LST	Launch Support Team
LWO	Launch Weather Officer
MFCT	Mission Flight Control Team

MC	Mission Controller (ROMSSC)
MCO	Monitor and Control Operator
MCS	Mission Control Supervisor (ROMSSC)
MFCO	Mission Flight Control Officer
OD	Operations Director
OSM	Operations Safety Manager
Program	Forward Observer
PSM	Program Support Manager
RC	Range Coordinator
RCO	Range Control Officer
RM	Range Manager
ROC	Range Operations Commander
RSTS	Range Safety Telemetry System (FSPO)
RTDC-1	Real Time Data Controller-1 (MFCO "String 1", ROMSSC)
RTDC-2	Real Time Data Controller-2 (SMFCO "String 2", ROMSSC)
SCMDR	Spacelift Commander
SE	Chief of Safety/Chief Engineer
SMFCO	Senior Mission Flight Control Officer
TMO	Telemetry Observer

1.5.2. Terms.

ACC	Area Control Center
ADS	Acquisition Data System
AGC	Automatic Gain Control
AMPS	Automated Meteorological Profiling System
AOS	Acquisition of Signal
AOV	Acquisition of View
AZ	Azimuth
BCN	Beacon Tracking Mode (Transponder)
BLAST	Sonic Overpressure Prediction Computer Model
BOA	Broad Ocean Area
CCPS	Central Control Processing System
CCS	Central Command System
CCT	Command and Control Transmitter (also CT)
CCTV	Closed Circuit Television
CMD	Command
CM'	Computer Malfunction Prime
COLA	Collision Avoidance
CRD	Command Receiver Decoder
D	Desired
DCO	Data Control Officer
DPANYL	Teletype Circuit RY1462 to ROMSSC for Wind Data
EOM	End of [flight control] Mission

ER	Eastern Range
ETB	Engineering Test Basis
FCA	Flight Caution Area
FHA	Flight Hazard Area
FMS	Frequency Monitoring Station
FTS	Flight Termination System
GMD	Ground-based Midcourse Defense (formerly NMD)
GMDS	Ground-based Midcourse Defense Segment (formerly NMD)
GPS	Global Positioning System
IG	Inertial Guidance
IIP	Instantaneous Impact Point
ILL	Impact Limit Line
JB	Junction Box
KMR	Kwajalein Missile Range (now RTS)
KT'	Airborne Computer Halt (MM III) (NS-20A)
LARA	Launch Risk Analysis
LCB	Limited Commitment Basis
LF	Launch Facility
LO	Liftoff
LOS	Loss of Signal
LOV	Loss of View
M	Mandatory
MAB	Missile Assembly Building
MDI	Mission Discrete Indicator
MDPS	Metric Data Processing System
MFC	Mission Flight Control
MFCC	Mission Flight Control Center
MFCS	Mission Flight Control System
MFTGS	Missile Flight Termination Ground System
MIPIR	Missile Precision Instrumentation Radar
MM	Minuteman
MSDB	Mission Support Database
MTE	Minimum Time to Endanger
NAWC	Naval Air Warfare Center, Point Mugu NAS, CA
NMD	National Missile Defense (now GMD)
NVAFB	North Vandenberg Air Force Base
OD	Operation Directive/Operations Director
PBV	Post Boost Vehicle
PIGA	Pendulous Integrating Gyroscopic Accelerometer (MMIII)
PP	Present Position
PPAFS	Pillar Point AFS
R	Required
RAS	Remote Access Server
RCC	Range Control Center

RCVR	Receiver
REEDM	Rocket Engine Exhaust Diffusion Model
RF	Radio Frequency
RGLS	Rail Garrison Launch Site
RICC	Range Instrumentation Control Center
RLCC	Remote Launch Control Center
ROMSSC	Range Operation, Maintenance, and Support Services Contract
RSDS	Range Safety Display System
RSTS	Range Safety Telemetry System
RSVADS	Range Safety Vehicle Attitude Display System
RTAMPS	Real-Time Automated Meteorological Profiling system
RTS	Range Tracking System or Ronald Reagan Ballistic Missile Defense Test Site or Reagan Test Site (formerly KMR)
S&A	Status and Alert
SE	Safety Office (30 SW/SE) or Chief of Safety
SEO	Mission Flight Control Operations Office
SEY	Flight Analysis Office
SKN	Skin Track Mode
SLC	Space Launch Complex
SNI	San Nicholas Island
SPOF	Single Point of Failure
SRB	Solid Rocket Booster
SRM	Solid Rocket Motor
SRMU	Solid Rocket Motor Upgrade
STS	Secure Transmission System
SVAFB	South Vandenberg Air Force Base
SYNC	Synchronization
TADL	Terminal Area Destruct Line (aka, "Schmoo")
TAER	Telemetry Analog Equipment Room
TIPS	Telemetry Integrated Processing System
THZ	Toxic Hazard Zone
TM	Telemetry (also TLM)
TMIG	Telemetry or Telemetered Inertial Guidance
TMO	Telemetry Observer
TNAR	TM Doppler/Nominal Acceleration/Radar Kalman Filter
TRS	Telemetry Receiving Site
TSP	Test Support Position
TT	Thrust Termination
TT&C	Telemetry, Tracking, and Commanding
UDS	Universal Documentation System
UPRR	Union Pacific Railroad
USAKA	US Army Kwajalein Atoll (now RTS)
VAFB	Vandenberg Air Force Base
VDL	Voice Direct Line

WCC	Weather Control Center
WR	Western Range
WRCC	Western Range Control Center
WROCC	Western Range Operations Control Center

CHAPTER 2 - OPERATIONAL CONCEPTS

2.1. Mission Flight Control Terms.

2.1.1. Positive Control. The ability of the MFCO to activate the airborne Flight Termination System (FTS) through the initiation of command destruct orders at any time during the Flight Control mission.

2.1.2. Impact Limit Line (ILL). The boundary of the controlled area surrounding the launch site within which hazardous debris must be contained. Area clearance actions take place within the ILL. During launch operations, only mission-essential personnel are allowed within the ILL.

2.1.3. Flight Hazard Area (FHA). The controlled surface area and airspace about the launch site and flight azimuth where individual risk from a malfunction during the early phase of flight exceeds a probability of 1×10^{-5} . Because the risk of serious injury or death from blast overpressure or debris is significant, only mission-essential personnel in approved blast hardened structures with adequate breathing protection are permitted in this area during launch.

2.1.4. Flight Caution Area (FCA). The controlled surface area and airspace outside the Flight Hazard Area where individual risk from a launch vehicle malfunction during the early phase of flight exceeds a probability of 1×10^{-6} . When activated, only personnel essential to the launch operation (mission-essential) with adequate breathing protection are permitted in this area.

2.1.5. Acquisition Time. The time after liftoff when a sensor is reasonably able to acquire data (e.g., radar, telemetry antenna, etc.). Acquisition times will vary depending on launch site, skin or transponder track, atmospheric conditions, etc. The Real-Time Data Controller (RTDC) provides expected radar acquisition times to the MFCO for each operation on the day of launch.

2.1.6. Red Time. The time after liftoff at which a destruct action is required to contain the fragments of a non-programming vehicle within the impact limit line. The computation includes launch vehicle turn rates, fragment sizes, MFCO reaction time, aerodynamic effects and launch vehicle hazard radius. The MFCO is authorized to terminate the flight of a non-programming vehicle at Red Time.

2.1.7. Minimum Time to Endanger (MTE). The first time that a launch vehicle has sufficient energy to hazard the area outside of the ILL (assumes flight in the worst case direction). If no sensor has acquired launch vehicle track by MTE, the MFCO is authorized to terminate the flight.

2.1.8. Critical Times. The time it would take the launch vehicle Instantaneous Impact Point (IIP) to turn and cross the nearest destruct line from a given point on the nominal trajectory. Critical times are displayed as a tool for responding to a loss of all tracking data during powered flight. When presented with a complete loss of tracking data, the MFCO is authorized to terminate the flight of the vehicle at the expiration of the critical time. When a launch vehicle no longer has the energy for the IIP to reach a destruct line from the nominal trajectory, it is deemed "Safe all the way."

2.1.9. Instantaneous Impact Point (IIP). The predicted point where an intact launch vehicle would impact if powered flight were terminated at a given time in flight.

2.1.10. Launch Data Letter. The Range Operation, Maintenance and Support Services Contractor (ROMSSC) prepares this letter containing flight parameters and safety information for each launch operation. The data includes MTE, red time, discrete event times, Range Safety Display System (RSDS) maps and displays showing trajectory, ILL, and destruct lines; critical times, instrumentation aspect angles, Command and Control Transmitter (CCT) switch times and loss-of-signal (LOS) times, flight control end of mission (EOM) times, times to endanger populated areas and areas considered hazardous to airmen or mariners.

2.2. Flight Control Mission. The Flight Control mission begins when the FTS Command Receiver Decoders (CRD) are first activated during the countdown and continues throughout powered flight. During this period, the Flight Control Team must know the status of launch vehicle and ground systems, and be able to maintain positive control of the vehicle.

2.2.1. End of Flight Control Mission (EOM). Depending on the launch program and specific trajectory, flight control EOM may extend through one of the following events: orbital insertion, end of powered flight (either by fuel depletion or flight computer shutdown), nominal loss of signal (LOS) due to trajectory, planned vehicle event or vehicle aspect angle; separation of the last stage containing FTS, or completion of either post-destruct or errant missile actions.

2.2.2. Positive control is maintained until EOM, but may be extended, at launch agency request, until sufficient physical separation is achieved between a payload and a separated stage containing the FTS, or until the FTS is commanded off.

2.3. Mission Flight Control (MFC) Requirements Philosophy. The fundamental MFC requirement is that no single point of failure (SPOF) will negate the MFCO's ability to maintain positive control over a launch vehicle through the duration of the Flight Control mission. Critical systems, such as the Missile Flight Termination Ground System (MFTGS) and airborne FTS, are designed with no SPOF in mind. No SPOF requirements exist in systems that do not directly relate to positive control, such as real-time metric data processing and display, although their reliability is still extremely important as their degradation or failure may lead to flight termination.

2.3.1. The following high-level requirements set the overall capabilities needed by the mission flight control system. If any of these requirements are not met, the system fails to meet flight readiness criteria:

Robust System. No single point of failure in the flight control system will deny the MFCO's ability to maintain positive control during the launch countdown or flight of a launch vehicle. Although component level failures may occur, they will result in graceful degradation rather than complete system failure.

Continuous Command Capability. The command system can furnish the MFCO sole, uninterrupted control of the FTS from the first receiver turn-on through EOM.

Knowledge of Vehicle Position and Performance. Tracking and telemetry systems will be available to confirm vehicle position and performance from liftoff to EOM.

Real-time Status of Critical Telemetry, Tracking, and Commanding (TT&C) Systems. Status of vehicle and ground-based TT&C systems critical to maintaining positive control will be indicated in real-time at the MFCO console.

2.3.2. Levels of Decision Authority. The Universal Documentation System (UDS) specifies priorities for support items in terms of mandatory, required, and desired classifications. The level of requirement determines the decision authority for waivers. During the generation phase of a launch mission the 30th Space Wing Commander is the waiver authority for items that impact public safety and the Chief of Safety is the waiver authority for all other safety issues. During the execution phase of a launch mission (beginning at countdown initiation) the Spacelift Commander (SCMDR) is the waiver authority for safety MANDATORY requirements and the S/MFCO is the waiver authority for all other safety operations requirements. Reference Table 2.1 for execution phase levels of safety decision authority.

MANDATORY: Lack of support would severely impact flight safety or unnecessarily endanger the mission. A safety hold will be imposed for failure of any MANDATORY items. Waivers are granted by the SCMDR. Immediate outage notification to the SMFCO or MFCO is required throughout the countdown and flight control period of flight.

REQUIRED: Lack of support could substantially impact flight safety. A safety hold will not be imposed for failure of REQUIRED support items. The SMFCO, MFCO (in the absence of the SMFCO), or the SCMDR may upgrade to MANDATORY as deemed necessary. Outage notification of REQUIRED items is necessary until the MFCO issues Safety GREEN.

DESIRED: Lack of support will not impact flight safety. A safety hold will not be imposed for failure of DESIRED support items. The SMFCO, MFCO (in the absence of the SMFCO), or the SCMDR may upgrade to REQUIRED or MANDATORY as deemed necessary. Outage notification of DESIRED items is necessary until the MFCO issues Safety GREEN.

Table 2.1. Safety Levels of Decision Authority (Execution Phase).

PRIORITY	OPERATIONAL RULES	WAIVER AUTHORITY
MANDATORY	<ul style="list-style-type: none"> - HOLD PRIOR TO LAUNCH - LAUNCH (IF WAIVED) - ABORT TERMINAL COUNT (IF POSSIBLE) 	SCMDR
REQUIRED	<ul style="list-style-type: none"> - NOTIFY SMFCO - UPGRADE TO MANDATORY (IF CONDITIONS WARRANT) 	SMFCO/MFCO
DESIRED	<ul style="list-style-type: none"> - NOTIFY SMFCO - UPGRADE TO REQUIRED OR MANDATORY (IF CONDITIONS WARRANT) 	SMFCO/MFCO

2.3.3. Safety MANDATORY operations requirements are designed to provide the minimum capability needed to ensure adequate control of the vehicle's hazards throughout powered flight. Redundancy in systems that provide vehicle performance data serves to avoid situations that could result in termination of a non-hazardous vehicle, ensuring flight control does not unduly endanger the launch mission. In some instances, launch agencies may wish to levy additional requirements for a mission in order to provide additional margin beyond the basic Safety requirements. In other instances, launch agencies may have significant mission needs that require them to evaluate the risk of destroying a nominal vehicle versus other mission factors. In this case, 30 SW/SEO will discuss with the launch agency liftoff requirements that can be lessened with their consent, as well as the inherent risks involved. Under no circumstances will public safety be sacrificed by waiving such requirements. In addition, during flight, the SCMDR delegates authority to the MFCOs to take control of any active range assets needed to protect public safety.

2.4. Flight Readiness Criteria (Go/No-Go). The MFCO will decide flight readiness based on meeting the following criteria. The Launch Weather Officer (LWO) evaluates and gives a go/no-go decision on Safety weather constraints. If any violation of these criteria occurs after providing Safety Clear to Launch (S&A GREEN), Safety will be in a RED condition. For Peacekeeper and Minuteman III launch operations only, the failure of a single MANDATORY processor or display system (after T-50 seconds for PK; T-45 seconds for MM III) will not cause a hold. Excluded from this special rule are command systems (ground and airborne), radar and telemetry (site) requirements. The use of a special rule increases risk to a mission by potentially eliminating flight redundancy in a processor or display system. If a special rule is applied, mission rules and flight termination criteria remain unchanged and effective.

2.4.1. Range instrumentation and equipment. MANDATORY equipment is available to support.

2.4.2. Vehicle flight safety systems. C-band transponder, FTS, and telemetry systems are providing nominal indications.

2.4.3. Area Clearance. Evaluated by the ACO, LST and OSM (or NASA CSO).

2.4.3.1. All unauthorized personnel and property are clear from within the impact limit line (ILL).

2.4.3.2. All surface vessels are clear of hazardous areas.

2.4.3.3. Designated airspace is closed and clear of unauthorized aircraft.

2.4.3.4. All rail traffic is clear from the ILL.

2.4.4. Risk Mitigation. Risk levels from debris, toxic materials, sonic overpressure, collision avoidance or other hazards are within established standards for mission essential personnel, non-mission essential personnel and critical resources.

2.4.5. All necessary checks are successfully completed and required information to confirm safety readiness is available.

2.4.6. The SMFCO has no reason to believe that personnel or property are at any undue risk.

2.5. Flight Termination Criteria. MFCOs are authorized to terminate flight of a launch vehicle when any of the following criteria are met. In all instances, the MFCO shall make a decision concerning continued flight or termination based on interpretation of real-time events and mission rules, all available data sources and sound professional judgment. More specific rules are contained in the mission rules document for each launch vehicle type.

2.5.1. Public Endangerment. Valid data shows the launch vehicle has violated established safety criteria.

2.5.2. Erratic Performance. Includes erratic flight, impending impact or a failing FTS to the point where the potential exists for the MFCO to lose positive control. Termination action may be taken even though the vehicle has not violated flight safety criteria.

2.5.3. Unknown Performance. The performance of the launch vehicle is unknown and the capability exists to violate flight safety criteria.

2.6. Mission Flight Control System (MFCS). The MFCS provides the MFCO with real-time flight performance data, the means to terminate flight of vehicles that violate safety constraints and the communications capability to coordinate with those people necessary to ensure safety criteria are met. The principal subsystems of the MFCS include airborne tracking and telemetered vehicle information, metric and telemetric data acquisition, data processing, display, command transmission, airborne flight termination system, communication, pre-launch display and data development and pre-launch safety analysis.

2.6.1. Airborne Tracking Systems. An airborne C-band transponder provides an RF receiver/transmitter that enhances radar track of the launch vehicle. Telemetered Inertial Guidance (TMIG) is vehicle-derived state vector (position and velocity data), as sampled from its guidance subsystem and subsequently processed by ground telemetry systems, which is transmitted as vehicle telemetry. TMIG is typically very accurate. Both the C-band transponder and TMIG may be susceptible to failure during major shock events such as staging. TMIG is validated after liftoff and subsequent shock events with at least one other tracking source before being considered an adequate tracking source itself. Global Positioning Satellite (GPS) aided tracking systems are under development, but not currently approved for WR use.

2.6.2. Radars. Radars are currently the prime tracking sources in the early stages of flight. Radar data are used to validate TMIG after launch and after each staging event. Radars are capable of tracking objects in both transponder mode and skin mode. Several factors affect the number and types of radars needed, including mission profile, accuracy requirements uprange and in the terminal area, vehicle performance and the need for geographic diversity. Should the C-band transponder fail, radars continue to provide skin track data to the MFCS.

2.6.2.1. Missile Instrumentation Precision Radars (MIPIR). A class of radar that uses a 29-foot antenna and a high power transmitter to provide accurate longer range track data and smaller target detection.

2.6.2.2. FPS-16 Class Radars. A class of radar that uses a 12-foot antenna and a 1-megawatt transmitter to provide high precision track at close ranges. These systems also provide higher antenna slew rates than the MIPIRs.

2.6.2.3. Phased Array Radars. Phased array radars use an electronically steered antenna beam in lieu of an antenna dish. As implemented at Vandenberg AFB, the Multiple Object Tracking Radar (MOTR) provides tracking characteristics that are similar to the FPS-16 class, with the additional capability of tracking up to 40 objects at a time.

2.6.2.4. Telemetry Doppler, Nominal Acceleration, and Radar (TNAR) Kalman Filter. Primarily useful for targeted ballistic missile impact missions, the TNAR Kalman filter may allow a mission to continue in the populated terminal area should TMIG fail in flight. TNAR has the ability to take multiple radar and telemetry Doppler inputs and calculate a smooth IIP that can be used in place of the TMIG IIP under certain conditions. Individually, radars do not provide usable IIP late in flight (typically around T+300 seconds). TNAR provides a relatively noise-free IIP, based on radar input, that can be used in place of the TMIG IIP and allow mission completion. Accuracy of the TNAR-generated IIP is based on the quality, number and geographic diversity of range and range rate data used in computing the TNAR solution. TNAR can be utilized, but is not required, for any space mission and for all ballistic missions that terminate in broad ocean areas (BOA).

2.6.2.5. Geographically Diverse Radar. TNAR IIP accuracy is significantly improved as tracking sources provide valid data, particularly range rate data, from a variety of geographic locations. Ballistic missions that terminate near populated areas may be heavily dependent on TNAR as a

tracking source. Pillar Point (PPAFS), Vandenberg AFB, and San Nicholas Island sensors are nearly collinear, thus provide minimal east/west diversity for ballistic trajectories towards Reagan Test Site (RTS). Radars at other locations, such as Kaena Point in Hawaii, may be used to add diversity to the tracking data solution, thereby enhancing TNAR accuracy. Geographic diversity requirements will be determined on a mission-by-mission basis by 30 SW/SEY.

2.6.3. Acquisition. TT&C sites have a variety of methods for acquiring acquisition or slaving data, including a combination of digital acquisition sources, inter-site acquisition sources, and designated secondary acquisition points. Digital acquisition sources include Acquisition Data System (ADS) acquisition data, Digital Information Processing System (DIPS) acquisition data and inter-site acquisition source data.

2.6.3.1. Acquisition Data System (ADS). ADS has the capability to process, display, and record sensor tracking data. It also supplies acquisition and slaving data to numerous range sensors and transmitters. Its processing and display properties can provide the MFCO with IIP data necessary to continue spacelift mission flights should both strings of MDPS/RSDS fail. For classified ballistic missions, this mission continuation capability is limited. TNAR terminal area destruct lines (TADL) and background data cannot be displayed on ADS, which leaves only TMIG TADLs and IIP information available for MFCO evaluation.

2.6.3.2. Digital Information Processing System (DIPS). DIPS is a combination firmware and software system. It provides acquisition and slaving data, it can drive the Area Control Center (ACC) plotboards and it serves as a backup to ADS.

2.6.4. Telemetry. Telemetered data provides the Mission Flight Control Team (MFCT) with indications of vehicle and airborne safety systems performance. It is used to monitor readiness of airborne systems during countdown and pre-launch tests, and to monitor the state of airborne guidance, control, and propulsion systems during flight.

2.6.4.1. Stripchart Recorders. Two stripchart recorders are utilized in the Mission Flight Control Center (MFCC) to display selected telemetered items of interest to include vehicle yaw, pitch and roll; chamber pressure of thrusting stages and Automatic Gain Control (AGC).

2.6.4.2. Range Safety Telemetry System (RSTS). RSTS displays telemetered FTS status to the Flight Safety Project Officer (FSPO) located in the MFCC using a pair of redundant processors and display systems. Through a second set of redundant processors, RSTS also has the capability to process TMIG for real time display to the MFCO.

2.6.5. Airborne FTS Component. The airborne FTS includes the command receivers and thrust termination or destruct system unique to each launch vehicle.

2.6.6. Command Transmission. The Mission Flight Termination Ground System (MFTGS) consists of local and remote Command and Control Transmitter (CCT) sites and a Central Command System (CCS) for their control and status. An older system currently undergoing phase-

out, Central Control Processing System (CCPS), also exists to provide the same control and status for non-CCS modified CCT sites. Site-to-site automatic failover is a function of the CCS. If site-to-site automatic failover is operational, CCT systems need not be collocated. If site-to-site automatic failover is not operational, at least two transmitter systems must be collocated with intra-site automatic failover capability.

2.6.7. Skyscreen. The skyscreen system has three elements: the forward observer, the skyscreen TV and the associated instrumentation and communications needed to send skyscreen information to the MFCC. Two skyscreen systems support each launch and are designated “Back Az” and “Program”. The Back Az position is located uprange from the launch point along the flight azimuth. The Program position is located crossrange from the launch point. The forward observer and TV may or may not be collocated.

2.6.8. Metric Data Processing and Display. Composed of computers systems that provide for real-time processing and display of both metric and telemetered data. The current architecture consists of a redundant and independent set of computers that host both data processing and display functions simultaneously.

2.6.8.1. Metric Data Processing System (MDPS). MDPS software, redundantly hosted on two independent computers, processes digital data and provide output to several destinations to drive MFCC displays. MDPS has the capability to automatically select the “best source” from all sources input, and provides a variety of outputs including IIP, present position, velocity, debris patterns and discrete events. Operating in the non-real-time mode, MDPS generates nominal and history tapes, acquisition angles, and RSDS background data-bases, as well as executing flight analysis programs.

2.6.8.2. Range Safety Display System (RSDS). RSDS software, redundantly hosted on the same two independent computers as MDPS, provides a continuous real-time geographic display of launch vehicle position, performance and associated factors that affect missile flight safety. RSDS also provides information required for post-destruct and errant missile reporting. This data is presented on the alphanumeric display when selected by the MFCO.

CHAPTER 3 - GENERAL REQUIREMENTS

3.0. General. The following baseline requirements cover the majority of launch systems flown from the Western Range. Complete requirements for a particular launch program are documented in attached annexes for each launch vehicle type. In some cases additional assets may need to be scheduled in order to meet reliability, accuracy and timeliness requirements as specified in EWR 127-1 and WRR 127-9. Peculiarities of launch systems or mission parameters may dictate deviations from these general requirements. Mission specific requirements may be published by the SMFCO as a mission-specific temporary change to the RSOR.

3.1. Range Tracking Systems (RTS). Two adequate and independent instrumentation data sources from liftoff through flight control end of mission are MANDATORY. Sources provided to meet these requirements must also comply with RTS performance requirements (adequacy, accuracy, timeliness, reliability and independence) as specified in EWR 127-1. The Mission Flight Control (MFC) data processing systems use the range tracking systems to provide the MFCO with real-time Present Position (PP) and Instantaneous Impact Point (IIP) displays.

3.1.1. Radar. Radars supporting a MANDATORY requirement must be capable of tracking in both skin and transponder modes. Radars supporting the MANDATORY and REQUIRED TNAR Filter requirement must be transponder mode range-rate capable. A radar slaving source is REQUIRED. For first flights, tracking of jettisoned strap-on solid rocket motors/boosters (SRM/SRB) from release to impact is REQUIRED.

3.1.1.1. Local. Each Vandenberg AFB radar supporting the MANDATORY tracking requirement in paragraph 3.1 must be capable of providing quality on-target track of either the booster or launch vehicle transponder no later than three (3) seconds prior to minimum time to endanger (MTE-3 sec). Data from liftoff is REQUIRED. Additional Vandenberg AFB radars are REQUIRED as specified in attached launch vehicle annexes. All scheduled radars must be capable of providing adequate track through flight control EOM.

3.1.1.2. Remote. For launch vehicles with solid fuel motors, remote radar coverage (downrange and/or crossrange from Vandenberg AFB) is MANDATORY for liftoff to mitigate solid rocket motor plume effects.

3.1.1.3. TNAR Filter. An adequate TNAR filter solution is MANDATORY for ballistic missions that are targeted for populated terminal areas. In TNAR context, the term “adequate” is defined as a solution that enables the MFCO to determine if the post-boost vehicle violates established in-flight safety criteria. Two distinct needs can be derived from this filter requirement: radar geographic diversity to support in-flight safety criteria (TNAR terminal area destruct lines [TADL]) and inputs needed to ensure performance of the filter solution (radar diversity as well as quantity and quality of filter input). Flight analysis for a particular mission will determine if there are specific radars necessary to generate the in-flight safety criteria. As such, a minimum of two geographically diverse radars with transponder mode range-rate capability are MANDATORY to ensure the validity of the TNAR TADLs. A third, non-geographically diverse transponder mode range-rate

radar is REQUIRED. Additional transponder mode range-rate capable radars may need to be scheduled in order to ensure acceptable filter performance. Some missions may require the inclusion of a specific remote or midrange radar into the filter to meet these requirements. 30 SW/SEY is the OPR for the determination of these additional requirements. The geographically diverse radars may also fulfill the local and remote radar requirements, as appropriate.

3.1.2. Transponder. A trackable non-coherent C-band transponder on the launch vehicle is MANDATORY. A trackable coherent C-band transponder on the launch vehicle is MANDATORY for ballistic vehicles that are targeted for populated terminal areas for TNAR filter support.

3.1.3. Telemetered Inertial Guidance (TMIG). For programs that utilize an inertial guidance system, one string of TMIG present position and IIP data is MANDATORY and a second string is REQUIRED. TMIG requires in-flight validation after liftoff and subsequent shock events against another tracking source before being considered an adequate tracking source.

3.1.4. Global Positioning System (GPS). The use of a GPS translator or receiver shall be considered on a case-by-case basis until adequate experience has been gained to define these requirements. For launch programs that are evaluating or testing GPS units, one string of GPS present position and IIP data is REQUIRED.

3.2. Telemetry. Receipt of telemetered data, specified in each vehicle annex, is MANDATORY from the first FTS turn-on through flight control EOM. A remote TM site is MANDATORY for launch vehicles with solid fuel motors to mitigate solid rocket motor plume effects. A telemetry slaving source is REQUIRED. Telemetered performance, guidance and FTS data are utilized by the MFCT to evaluate flight performance.

3.3. Command. The capture of CRDs from first turn on through flight control EOM is MANDATORY. "Capture" is defined as the receipt of the carrier signal such that AGC levels are above "Guaranteed" as well as the receipt and decoding of either Check Channel or Pilot Tone. The MFCT uses command capability to test and control the vehicle FTS and to terminate anomalous flight. Command system assets provided to Range Safety to meet this requirement must comply with performance requirements as specified in WRR 127-9.

3.3.1. Command systems. A centrally controlled command processing system is MANDATORY. It must provide the MFCT command access to all supporting command transmitters. Secure code capability is MANDATORY. A secondary commanding source (site initiated command capability) is REQUIRED.

3.3.2. Command transmitters. Two Vandenberg AFB command transmitters with directional and omni-directional antennas and RF visibility to the launch site are MANDATORY. For space launch vehicles, the primary transmitter system must have line-of-site to the launch pad. For launch vehicles with solid fuel motors, two remote transmitters (downrange and/or crossrange from Vandenberg AFB) with directional antennas are MANDATORY for liftoff to overcome solid rocket motor plume effects. Power must be supplied to the MANDATORY command transmitters in such

a way so that the loss of a single source of power will not disable both transmitters. For missions utilizing secure CRDs, secure code capability at the command transmitter sites is REQUIRED in order to provide a secondary secure commanding source. Transmitter switch times are based upon a mission specific review of the antenna/vehicle aspect angles and antenna elevation angles. Elevation of the directional antennas will not be less than three degrees, unless directed by the MFCO, in order to avoid multipathing. Command configuration, transmitter and antenna switch times are specified in each vehicle annex.

3.3.3. Command slaving source. A real-time slaving source is MANDATORY for the directional antenna at each command transmitter site prime for supporting MANDATORY command transmitter requirements. For ballistic missions only, a CCT slaving source for the directional antenna for the prime local transmitters is REQUIRED. Slaving ensures accurate pointing during non-nominal flight.

3.3.4. Command failover. Automatic failover capability connecting all supporting command transmitters is MANDATORY. Failover capability may be a combination of internal failover at a site and centrally controlled failover.

3.3.5. Flight termination system (FTS). A redundant launch vehicle FTS is MANDATORY. After the MFCO assumes control of the ground portion of the command system, the CRDs shall not be allowed to be turned on or off without the specific approval of the MFCO unless it is a scheduled countdown item with the MFCO monitoring.

3.4. Displays. The continuous real-time display of launch vehicle performance and system status that affects flight safety is MANDATORY. The MFCT monitors several displays to provide real-time status of critical launch vehicle and range systems.

3.4.1. Tracking Display. Two independent display systems (currently Range Safety Display Systems [RSDS]) are MANDATORY for displaying vehicle present position and IIP. Each system will output to one MANDATORY and one REQUIRED display for the MFCO and one MANDATORY and one REQUIRED display for the RTDC. Display markers for support aircraft, seacraft, oil platforms and unsheltered launch area personnel are REQUIRED. A mission continuation display (currently ADS) is REQUIRED in the event of a catastrophic failure of the primary tracking display system.

3.4.2. MFCO Stripchart Display. Two MFCC stripchart recorders are REQUIRED. MFCC stripchart recorder console lights are REQUIRED. Configure the red and green lights above each stripchart recorder such that the green lights are illuminated when the telemetry bit stream is in sync and the red lights are illuminated when the bit stream is out of sync. For Minuteman III NS-20 missions, configure the indicator lights to display computer malfunction (CM') on console #1 and guidance shutdown (KT') on console #2. MFCC stripchart recorders should be configured for best source display. Configure each stripchart recorder channel for full-scale data display.

3.4.2.1. Chamber Pressure. Booster chamber pressure telemetry for each engine is REQUIRED. MFCC stripchart recorder telemetry channel assignments are specified in vehicle specific annexes.

3.4.2.2. Steering. Vehicle steering (yaw, pitch, roll) is REQUIRED. MFCC stripchart recorder telemetry channel assignments are specified in vehicle specific annexes.

3.4.2.3. Automatic Gain Control (AGC). Command Receiver Decoder (CRD) AGC levels are REQUIRED on both MFCC stripchart recorders.

3.4.3. FSPO Display. A real-time Range Safety telemetry display for the FSPO, capable of providing data until flight control EOM, is MANDATORY. In most cases, the Range User Range fulfills the requirement down to T-0 and the Range Safety Telemetry System (RSTS) fulfills the requirement during flight. FSPO, RSTS FSPO and RSTS QLDA-7 displays and stripcharts are MANDATORY, REQUIRED and DESIRED as specified in each vehicle annex. A redundant RSTS console is DESIRED. FSPO data display requirements are specified in each vehicle annex. See Appendix E, Flight Safety Project Officer Displays, for background information on RSTS console displays and a summary of FSPO display locations and requirements by program.

3.4.4. Command Status Display. A MFCO status panel is MANDATORY for each active centrally controlled command processing system.

3.4.5. Attitude Display. For Titan IV-B missions, a vehicle attitude display is REQUIRED on each string of RSDS. Day of launch weather conditions may require RSVADS to be upgraded to MANDATORY in order to ensure public safety. An attitude display assists in mitigating the sonic overpressure risk associated with the SRMUs by providing the MFCO with an early indication of non-nominal vehicle attitude.

3.4.6. Mission Discrete Indicators (MDIs). MDIs are REQUIRED. Indication of guidance shutdown on two of two strings of RSDS is REQUIRED for Minuteman III and Peacekeeper missions. Various other MDIs are specified in each vehicle annex and are REQUIRED on each string.

3.5. Communications.

3.5.1. Voice Communications. To avoid unauthorized dissemination of Flight Control communications and recordings, no individual, agency, or organization shall be permitted to monitor the MFCO composite circuits without the expressed written consent of 30 SW/SEO. Access to these circuits shall not be allowed at positions other than those specified in this document or through normal network control and monitoring. With the exception of impoundment, release of recordings of the Flight Control composite circuits to any individual, agency, or organization is prohibited without the expressed written consent of 30 SW/SEO. Range Safety shall be advised of all requests to monitor the MFCO composite circuits or requests for access to the circuit recordings.

3.5.1.1. MFCO Voice Circuits. The MANDATORY and REQUIRED voice networks (nets) and

voice direct lines (VDL) listed in Table 3.1, MFCO Voice Circuit Requirements, describe the voice circuit requirements at the MFCO-1 and MFCO-2 consoles. See figure 3-1 for Safety Net connectivity. Access by most positions on the MFCO Safety Net is MANDATORY, with most positions having both talk and continuous monitor capability. The exceptions are the REQUIRED positions of SCMDR, OD, SE, MCS and MC, all of which have only monitor capability. The REQUIRED Safety Engineering Net is composed of the following positions, all with talk and continuous monitor capability: SE, FSPO, RSTS FSPO, MFCO and SMFCO. See Table 3.2, Safety Engineering Net Composition. Table 3.3, RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements, describes the voice circuit requirements at the RSTS-1 and RSTS-2 consoles. Additional nets and/or VDLs may be specified in each vehicle annex. The standard SMFCO and MFCO communications panel configuration is shown at Appendix B.

Table 3.1. MFCO Voice Circuit Requirements

Comm Circuit	Requirement	Comm Circuit	Requirement
MFCO Safety Net	M	RSTS FSPO	R
Countdown Net	M	OSM (CSO)	R
CCT-1 Net	M	LST	R
Safety Engineering Net	R	Program	R
Range Safety Net	R	Back Az	R
CCT-2 Net	R	ROC	R
Emergency Net	R	RCO	R
SCMDR Conf Net	R	ACO	R
Safety Radio Net	R	LWO	R
Weather Conf Net	R	DCO	R
MFCO-1 (at MFCO-2)	R	MCS/MC	R
MFCO-2 (at MFCO-1)	R	SCMDR	R
CMD-1	R	OD	R
CMD-2	R	SE	R
RTDC-1	R	Command Post	R
RTDC-2	R	Launch Controller	R
TMO	R	Launch Director	R
FSPO	R	Class A Line	R

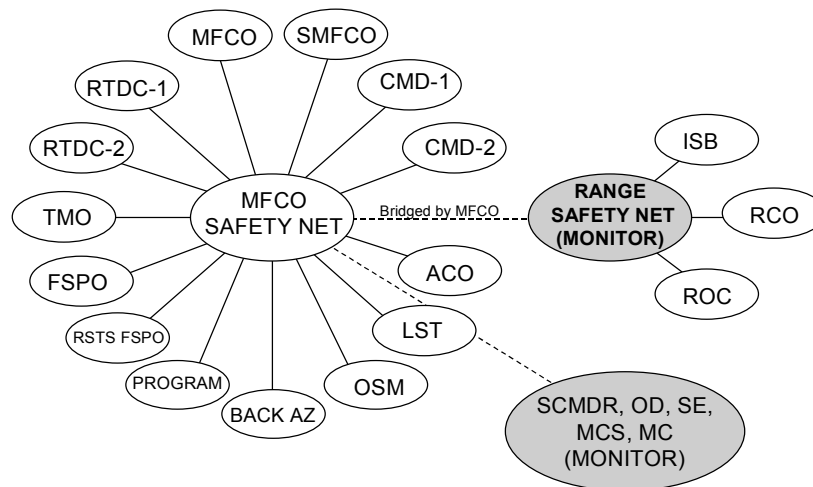
Table 3.2. Safety Engineering Net Composition

Safety Engineering Net	
MFCO	FSPO
SMFCO	RSTS FSPO
SE	

Table 3.3. RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements

Comm Circuit	RSTS FSPO	RSTS QLDA-7
MFCO Safety Net	M	D (Monitor)
Countdown Net	M	D
Safety Engineering Net	R	-
CCT-1 Net	R	-
CCT-2 Net	R	-
Weather Conf Net	R	-
S/MFCO	R	-
FSPO	R	D
RSTS FSPO	-	D
RCO	R	-
SE	R	-
Class A Line	R	D

Figure 3-1. MFCO Safety Net Configuration



3.5.1.2. Provide one MANDATORY and two REQUIRED Class A telephone lines and one telephone for the Flight Safety Analyst workstation in the MFCC. A Class A telephone line between the MFCC Toxic Analyst workstation and DC-90 is MANDATORY. Access to a secure telephone in the MFCC is REQUIRED.

3.5.1.3. LST Communications. The MANDATORY and REQUIRED communication circuits listed in Table 3.4, LST Fallback Communication Access Requirements, will be provided at all Fallback locations. These communication requirements only describe LST Team Chief needs and do not address those of the on-scene commander (OSC). Fallback support locations are summarized in Appendix A, Launch Area Clearance/Support Locations, and are also identified in each vehicle

requirements annex. This communication capability will be available from an outdoor location at each Fallback. Additionally, this communication capability will be provided within either the mobile command post vehicle (if available) or on-site facility, as applicable.

Table 3.4. LST Fallback Communication Access Requirements.

Comm Circuit	Requirement
MFCO Safety Net (T/M)	M
Countdown Net (M)	R
MFCO VDL	R
OSM VDL*	R
ACO VDL	R
DCG VDL (Bldg 11165)	R
Class A Line	R

T = Talk capability

M = Monitor only

* = CSO for SLC-2W launch operations

3.5.1.4. ISB Communications. Range Safety Net and Countdown Net monitors are REQUIRED. A Class A administrative telephone is REQUIRED. Range countdown clock is REQUIRED. CCTV capability is REQUIRED.

3.5.2. Status/Alert (S&A) System. Status/Alert modules are REQUIRED at the following positions: MFCO, SMFCO, RCO, ROC and launch agency. They are used to gather status and transmit Safety Go/No-Go status from various Safety support positions to the MFCO, and from the MFCO to the ROC, RCO and launch agency (typically the Launch Controller). S&A light inputs to the MFCOs are required from the following positions: OSM (CSO for SLC-2W), ACO, CMD-1, CMD-2, RTDC-1, RTDC-2, FSPO and RSTS FSPO.

3.5.3. Closed Circuit Television (CCTV). The following five (simultaneous) displays are REQUIRED on each MFCO console: Program TV, Back Az TV, Boat Plot, ADS and one long-range optic source. Available long-range optic sources may be split between each MFCO position. Best source video is REQUIRED at the ISB post.

3.5.4. Optics. One long-range optic source is REQUIRED. Provide real-time imagery under all lighting conditions capable of display on CCTV from AOV to LOV. Track the launch vehicle in the center of the frame. Two launch area video cameras, identified as Program and Back Az, are REQUIRED. Provide real-time imagery capable of display on CCTV from T-1:00 hour to LOV. Television van support locations for Program and Back Az are summarized in Appendix A, Launch Area Clearance/Support Locations, and are also identified in each vehicle annex.

3.5.5. **Missile Lift-off (MLO) Signal.** A positive lift-off indication to initiate instrumentation and data processing sequences is REQUIRED. The MLO signal may be generated automatically from the launch site or be manually initiated by the Range. If used, manual MLO initiation requires adequate visibility to the launch site in order to detect the liftoff event and will be documented as part of the weather Launch Commit Criteria.

3.5.6. **Command Communications.** The data transmission link between each CCT and the central command system will consist of two MANDATORY and two REQUIRED complete and independent duplex command and status circuits as well as one MANDATORY and one REQUIRED complete and independent duplex pointing data circuits. The data links will be designed and installed in a manner that involves the minimum possible routing and transmission method changes and will not time or equipment share with other systems. Timing requirements specified in WRR 127-9, Integrated Missile Flight Control Ground systems, apply.

3.5.7. **Range Communications.**

3.5.7.1. All mission essential personnel located inside the Impact Limit Line (ILL) will have means to communicate with their control centers and the LST.

3.5.7.2. The ability to “breakaway” from a launch vehicle anomaly when directed for all supporting aircraft whose Test Support Point (TSP) lies within the ILL is MANDATORY. The ability to receive this communication is REQUIRED. If this communication capability is lost, “no-radio” (NORDO) procedures will be implemented, which shall include a return to base procedure to avoid closed airspace (impact boxes and up range hazard and caution areas).

3.5.8. **Clocks.** Provide clock displays, the location of which allows them to be easily viewed by all console positions within the Mission Flight Control Center (MFCC). Clock displays should include Coordinated Universal Time (UTC), range countdown and pad countdown. Provide enough capability so that at least 2 different types of clock displays are visible simultaneously to all console positions within the MFCC.

3.6. Data Processing. The systems that process metric and telemetry data for output to MFCC displays are at the same level of decision authority as are required for the data to be displayed. A single data processor will not be used to drive a redundant display requirement. Processing and transfer of weather data to MFCC systems are required at the levels of decision authority as specified in each vehicle annex and in Appendix D, Weather System and Instrumentation Support Plan. The Launch Weather Officer (LWO) will produce a mission-specific support plan, which may change levels of decision authority, based upon the launch day forecast. The plan is also subject to change based upon actual launch day weather conditions.

3.7. Meteorological. Receipt of weather data is MANDATORY and/or REQUIRED, as specified in each vehicle annex. Weather data is used to analyze launch area risk and to ensure environmental conditions are within FTS operating specifications.

3.7.1. Local Atmospheric Data. Each vehicle annex outlines atmospheric data collection and delivery requirements. Data used for debris risk analysis consists of measured wind speed and direction from surface to 60 kft. Data used for toxic risk assessments consist of T-0 forecast of wind speed and direction, pressure, humidity, and air temperature from surface to 10 kft, height of cloud ceiling in meters, cloud sky coverage in eighths and height of the mixing layer plus observed turbulence measurements. Data used for overpressure risk assessments consist of T-0 forecast of wind speed and direction, humidity, and air temperature from surface to 20 kft plus observed turbulence measurements and height of the mixing layer in millibars. Data collection times may be used to schedule balloon releases.

3.7.2. Launch Commit Criteria. The Weather Aircraft is REQUIRED. Launch will not occur if weather conditions violate MANDATORY safety constraints for natural and triggered lightning, or triboelectrification, as described in Appendix C, Range Safety Weather Launch Commit Criteria. The LWO evaluates conditions and determines violations of these criteria. 30 WS/DOR is the OPR for updates to Range Safety weather criteria.

3.7.3. Post Operation. A reconstruction of actual T-0 wind speed, direction, humidity, pressure, air temperature, boundary mixing layer height, cloud sky coverage, height of cloud base ceiling and observed turbulence measurements from surface through 10 kft (20 kft for Titan IV-B) is REQUIRED within T+24 hours for toxic (and overpressure for Titan IV-B) analysis.

3.8. Area Clearance. Clearance of all non-mission essential personnel from areas under 30 SW surveillance and control is MANDATORY. Surveillance and clearance of airspace and on-shore and offshore surface areas is necessary to mitigate risk to personnel and property.

3.8.1. On-shore Surface. Clearance of all non-mission essential personnel from land areas within the ILL, including the Union Pacific Railroad (UPRR) right-of-way, is MANDATORY. UPRR clearance areas are summarized in Appendix A, Launch Area Clearance/Support Locations, and are also identified in each vehicle annex. Additional areas may be designated for evacuation based upon real-time hazard analysis. Essential personnel in the FHA will be sheltered in approved shelters. Launch area protection requirements are subject to change based on real-time analysis.

3.8.2. Offshore Surface. Clearance of danger zones and hazard areas, including uprange impact areas, is MANDATORY. Oil platforms may also be designated for sheltering or evacuation. Hazard area protection requirements are subject to change based on real-time analysis.

3.8.3. Airspace. Clearance of non-mission essential aircraft from launch safety airspace is MANDATORY. Mission-essential and associated operation aircraft will maintain approved Test Support Positions (TSP). Hazard areas may be established within launch safety airspace and are subject to change based on real-time analysis.

3.8.4. Surveillance. A surveillance helicopter is REQUIRED to conduct launch area surveillance for ground launches. Adequate surveillance of controlled areas is necessary to meet clearance requirements. Other assets such as airplanes and seacraft may be used to augment surveillance

capabilities. The UPRR Trainmaster is REQUIRED to coordinate and control rail traffic inside the railroad protection area. NAWC boat support is REQUIRED to control the boat exclusion area.

3.8.5. Recovery. Location (longitude and latitude), report of physical condition, and recovery of nozzle closures in the launch area (when safe and environmentally sound) is REQUIRED.

3.9. Data Requirements. All items listed in Table 3.4, Data Requirements, are REQUIRED and deliverable to 30 SW/SEO. In the event of an anomaly, impounded items are due as soon as possible after release by the Mishap Investigation Board. Except for the Mishap Investigation Board, listed data items (with the exception of item 380.00) cannot be released to anyone outside of 30 SW/SEO and 30 RANS/DOO-C without written authorization.

3.9.1. Data Recordings. Maintain MDPS, RSDS, RSTS and TM launch history recordings, suitable for playback on respective MFCC systems, for one year after completed launch operations. Maintain the prime system recording for the last five missions. Keep recordings indefinitely for anomalous flights, land impact missions and those missions specifically requested by 30 SW/SE. For redundant systems, only one launch history recording that captures the complete Flight Control mission is required.

Table 3.4. Data Requirements.

Data Item	Title	Data	Deliver
380.00	Post Launch Analysis Of Radar Systems, Letter Report	PLARS Report	17 WD
401.00	Video Cassette Recording	Format: SVHS (DVD is DESIRED) Time: T-90 seconds - LOV Video: Composite of Program, Back Az, LA-24, Santa Ynez, Pad/MST, Vehicle on-board, Chase aircraft, Carrier Aircraft Audio: Ch 1 MFCO Safety Net; Ch 2 IRIG-B	3 WD
416.00	Single Channel Voice Recording	Voice-operated MFCO communications (Compact Disc)	On Request
927.00	Events Display Recording – Range Safety	MFCC MFCO Stripchart Recorders 1 & 2	30 Minutes
928.00	Events Display Recording – Flight Safety	MFCC RSTS Stripchart Recorders 1 & 2	30 Minutes

PEACEKEEPER

1.0. General. This annex specifies flight control support requirements for Peacekeeper missions. After T-50 seconds the failure of a single MANDATORY range processor or display system will not cause a hold unless the item is MANDATORY for more than one requirement. All portions of the ground and airborne command systems are excluded from this special rule, as are radar and telemetry site requirements. The SMFCO may approve changes to this annex to accommodate operation-peculiar requirements.

2.0. Range Tracking Systems (RTS). Two adequate and independent instrumentation data sources from liftoff through flight control end of mission are MANDATORY.

2.1. Radar. Radars supporting a MANDATORY requirement must be capable of tracking in both skin and transponder modes. A radar slaving source is REQUIRED.

2.1.1. Local. One Vandenberg AFB radar with RF visibility to the launch site and ability to provide quality on-target track of either the booster or transponder no later than three (3) seconds prior to minimum time to endanger (MTE-3 sec) is MANDATORY for liftoff. Data from liftoff is REQUIRED. A second Vandenberg AFB radar is REQUIRED for liftoff.

2.1.2. Remote. One remote radar (downrange and/or crossrange from Vandenberg AFB) is MANDATORY for liftoff.

2.1.3. TNAR Filter. Radar inputs to create an adequate TNAR filter solution are MANDATORY. Two geographically diverse radars with transponder mode range-rate capability are MANDATORY. One non-geographically diverse radar with transponder mode range-rate capability is REQUIRED. Specific radars, to include midrange radars, may be designated to support the filter on a mission-by-mission basis, based upon flight analysis. 30 SW/SEY is the OPR for this determination.

2.2. Transponder. A trackable coherent C-band transponder on the launch vehicle is MANDATORY.

2.3. Telemetered Inertial Guidance (TMIG). One string of TMIG is MANDATORY and a second string is REQUIRED.

2.4. Global Positioning System (GPS). The use of a GPS translator or receiver shall be considered on a case-by-case basis until adequate experience has been gained to define these requirements. If flown, one string of GPS present position and IIP data is REQUIRED.

3.0. Telemetry. Receipt of telemetered data from the first FTS turn-on through flight control EOM is MANDATORY. One Vandenberg AFB TM site is MANDATORY and one remote TM site is MANDATORY. A telemetry slaving source is REQUIRED.

4.0. Command. The capture of the CRDs from turn on through flight control EOM is MANDATORY.

4.1. Command systems. A centrally controlled command processing system is MANDATORY. Configure CCS modes as follows:

CCS Mode	Configuration
Operational	Single Non-Redundant
Support	Standard
Failure	Dual

4.2. Command transmitters. Two Vandenberg AFB command transmitters with directional and omni-directional antennas and RF visibility to the launch site are MANDATORY. Two remote transmitters (downrange and/or crossrange from Vandenberg AFB) with directional antennas are MANDATORY. Power must be supplied to the MANDATORY command transmitters in such a way so that the loss of a single source of power will not disable both transmitters. Elevation of the directional antennas will not be less than three degrees unless directed by the MFCO. Carrier frequency is 416.5 MHz with +/- 30 kHz deviation per tone, Expanded Mode, Monitor 4. Initiate prime CCT switches from local to remote transmitter at T+55 seconds. Initiate local omni to directional antenna switch at T+60 seconds.

4.3. Command slaving source. A real-time slaving source is MANDATORY for the directional antenna at each remote command transmitter site prime for supporting the MANDATORY command transmitter requirement. A real-time slaving source is REQUIRED for the directional antennas for the prime local transmitters.

4.4. Command failover. Automatic failover capability connecting all supporting command transmitters is MANDATORY.

4.5. Flight termination system (FTS). A redundant launch vehicle FTS is MANDATORY.

5.0. Displays. The continuous real-time display of launch vehicle performance and system status that affects flight safety is MANDATORY.

5.1. Tracking Display. Two complete Range Safety Display Systems (RSDS) are MANDATORY. Each string will consist of one MANDATORY and one REQUIRED display for the MFCO and one MANDATORY and one REQUIRED display for the RTDC. Display markers for support aircraft, seacraft, oil platforms and unsheltered launch area personnel are REQUIRED. A mission continuation display is REQUIRED.

5.2. MFCO Stripchart Display. Two stripchart recorders are REQUIRED. MFCC stripchart recorder console lights are REQUIRED. Configure the red and green lights above each MFCC stripchart recorder such that the green lights are illuminated when the telemetry bit stream is in sync and the red lights are illuminated when the bit stream is out of sync. MFCC stripchart recorders

should be configured for best source display. Configure each stripchart recorder channel for full-scale data display.

5.2.1. Chamber Pressure. Booster chamber pressure telemetry for each engine is REQUIRED. Chamber pressure channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.2. Steering. Vehicle steering (yaw, pitch, roll) is REQUIRED. Steering channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.3. Automatic Gain Control (AGC). Command Receiver Decoder (CRD) AGC levels are REQUIRED. AGC assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

Table 5.1. MFCC Stripchart Recorder Channel Assignments.

Recorder #1

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/1	Command Receiver 1 Power	R
2/2	Command Receiver 2 Power	R
3/3	Command Receiver 1 Destruct	R
4/4	Command Receiver 2 Destruct	R
5/5	PBV Fuel Pressure	R
6/6	PBV Chamber Pressure	R
7/7	AGC Command Receiver 1	R
8/8	AGC Command Receiver 2	R
EVENT/9	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

Recorder #2

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/10	Stage 1 Chamber Pressure	R
2/11	Stage 2 Chamber Pressure	R
3/12	Stage 3 Chamber Pressure	R
4/13	Yaw Rate	R
5/14	Pitch Rate	R
6/15	Roll Rate	R
7/16	AGC Command Receiver 1	R
8/17	AGC Command Receiver 2	R
EVENT/18	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

5.3. FSPO Display. A real-time Range Safety telemetry display for the FSPO, capable of providing data until flight control EOM, is MANDATORY. FSPO display requirements are specified in Table 5.2, FSPO Display Locations & Requirements. RSTS FSPO console data display requirements are specified in Tables 3.3 through 3.6 at the end of this annex. A redundant RSTS console is DESIRED.

Table 5.2. FSPO Display Locations & Requirements.

Blockhouse		RSTS Display		RSTS Stripchart		QLDA-7 W/S	
T-0	Flight	T-0	Flight	T-0	Flight	T-0	Flight
R	N/C	R	R	M	M	D	D

5.4. Command Status Display. A MFCO status panel is MANDATORY for each active centrally controlled command processing system.

5.5. Attitude Display. Not required.

5.6. Mission Discrete Indicators (MDIs). MDIs are REQUIRED. Indication of guidance shutdown on two of two strings of RSDS is REQUIRED. MDI assignments are specified in Table 5.3, Mission Discrete Indicator Assignments.

Table 5.3. Mission Discrete Indicator Assignments.

<u>Parameter</u>	<u>Display</u>	<u>Display Color</u>	<u>Requirement</u>
TM Synchronization	SYNC	Red	R
SFIR Velocity Error	VERR	Red	R
Attitude Error	AERR	Red	R
Primary Power Fail	PWFL	Red	R
PBV Computer Shutdown	CS	Green	R
PBV Shutdown Confirmed	NULL	Green	R
Tone 4 Monitor, Receiver 1	TONE1	Red	R
Tone 4 Monitor, Receiver 2	TONE2	Red	R

6.0. Communications.

6.1. Voice Communications. MFCO voice communications are restricted from monitor access by agencies outside 30 SW/SE without written permission.

6.1.1. MFCO Voice Circuits. The MANDATORY and REQUIRED voice networks (nets) and voice direct lines (VDL) listed in Table 6.1, MFCO Voice Circuit Requirements, describe the voice circuit requirements at the MFCO-1 and MFCO-2 consoles. Access by all positions on the MFCO Safety Net is MANDATORY and each position will have talk and continuous monitor capability. RTS Range Safety Officer is added to REQUIRED Range Safety Net. Table 6.2, RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements, describes the voice circuit requirements at

the RSTS-1 and RSTS-2 consoles.

Table 6.1. MFCO Voice Circuit Requirements

Comm Circuit	Requirement	Comm Circuit	Requirement
MFCO Safety Net	M	RSTS FSPO*	R
Countdown Net	M	OSM*	R
CCT-1 Net	M	LST*	R
Safety Engineering Net	R	Program*	R
Range Safety Net	R	Back Az*	R
CCT-2 Net	R	ROC	R
Emergency Net	R	RCO	R
SCMDR Conf Net	R	ACO*	R
Safety Radio Net	R	LWO	R
Weather Conf Net	R	DCO	R
MFCO-1 (at MFCO-2)*	R	MCS/MC	R
MFCO-2 (at MFCO-1)*	R	SCMDR	R
CMD-1*	R	OD	R
CMD-2*	R	SE	R
RTDC-1*	R	Command Post	R
RTDC-2*	R	MCO	R
TMO*	R	Launch Director	R
FSPO*	R	Class A Line	R

* - Indicates positions with full MFCO Safety Net access.

Table 6.2. RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements

Comm Circuit	RSTS FSPO	RSTS QLDA-7
MFCO Safety Net	M	D (Monitor)
Countdown Net	M	D
Safety Engineering Net	R	-
CCT-1 Net	R	-
CCT-2 Net	R	-
Weather Conf Net	R	-
S/MFCO	R	-
FSPO	R	D
RSTS FSPO	-	D
RCO	R	-
SE	R	-
Class A Line	R	D

6.1.2. Provide one MANDATORY and two REQUIRED Class A telephone lines and one telephone for the Flight Safety Analyst workstation in the MFCC. A Class A telephone line between the MFCC Toxic Analyst workstation and DC-90 is MANDATORY. Access to a secure telephone in the MFCC is REQUIRED.

6.1.3. LST Communications. The MANDATORY and REQUIRED communication circuits listed in Table 6.3, LST Fallback Communication Access Requirements, will be provided at Fallback 21 for all launches utilizing either LF-02 or LF-05. This communication capability will be available from an outdoor location at Fallback 21. Additionally, this communication capability will be provided within the mobile command post vehicle (if available).

Table 6.3. LST Fallback Communication Access Requirements.

Comm Circuit	Requirement
MFCO Safety Net (T/M)	M
Countdown Net (M)	R
MFCO VDL	R
OSM VDL	R
ACO VDL	R
DCG VDL (Bldg 11165)	R
Class A Line	R

T = Talk capability

M = Monitor

6.1.4. ISB Communications. Range Safety Net and Countdown Net monitors are REQUIRED. A Class A administrative telephone is REQUIRED. Range countdown clock is REQUIRED. CCTV capability is REQUIRED.

6.2. Status/Alert (S&A) System. Status/Alert modules are REQUIRED at each MFCO console from the following positions: OSM, ACO, CMD-1, CMD-2, RTDC-1, RTDC-2, FSPO and RSTS FSPO.

6.3. Closed Circuit Television (CCTV). The following five (simultaneous) displays are REQUIRED on each MFCO console: Program TV, Back Az TV, Boat Plot, ADS and one long-range optic source. Available long-range optic sources may be split between each MFCO position. Best source video is REQUIRED at the ISB post.

6.4. Optics. One long-range optic source is REQUIRED. Two launch area video cameras, identified as Program and Back Az, are REQUIRED. Television van support locations for Program and Back Az are as follows:

Launch Site	Program Site	Back Az Site
LF-02	JB 85*	JB 86*
LF-05	JB 13*	JB 101

* - Indicates visibility to the launch pad

6.5. Missile Lift-off Signal. A positive lift-off indication is REQUIRED.

6.6. Command Communications. The data transmission link between each CCT and the central command system will consist of two MANDATORY and two REQUIRED complete and independent duplex command and status circuits as well as one MANDATORY and one REQUIRED complete and independent duplex pointing data circuits.

6.7. Range Communication.

6.7.1. All mission essential personnel located inside the Impact Limit Line (ILL) will have means to communicate with their control centers and the LST.

6.7.2. The ability to “breakaway” from a launch vehicle anomaly when directed for all supporting aircraft whose Test Support Point (TSP) lies within the ILL is MANDATORY. The ability to receive this communication is REQUIRED. If this communication capability is lost, "no-radio" (NORDO) procedures will be implemented, which shall include a return to base procedure to avoid closed airspace (impact boxes and up range hazard and caution areas).

6.8. Clocks. Visibility by all console positions within the Mission Flight Control Center (MFCC) to UTC, range countdown and pad clocks is REQUIRED.

7.0. Data Processing. The systems that process metric and telemetry data for output to MFCC displays are at the same level of decision authority as are required for the data to be displayed. Processing and transfer of weather data to MFCC systems are required at the levels of decision authority as specified in Appendix D, Peacekeeper Weather System and Instrumentation Support Plan.

8.0. Meteorological. Receipt of weather data is MANDATORY and/or REQUIRED, as specified in Table 8.1, Peacekeeper Atmospheric Data Requirements.

8.1. Local Atmospheric Data. See Table 8.1, Peacekeeper Atmospheric Data Requirements.

8.2. Launch Commit Criteria. The Weather Aircraft is REQUIRED. Launch will not occur if weather conditions violate MANDATORY safety constraints for natural and triggered lightning, or triboelectrification, as described in Appendix C, Range Safety Weather Launch Commit Criteria.

8.3. Post Operation. See Table 8.1, Peacekeeper Atmospheric Data Requirements.

9.0. Area Clearance. Clearance of all non-mission essential personnel from areas under 30 SW surveillance and control is MANDATORY.

9.1. On-shore Surface. Clearance of all non-mission essential personnel from land areas within the ILL, including the Union Pacific Railroad (UPRR) right-of-way, is MANDATORY. UPRR clearance is as follows (subject to day-of-launch real-time analysis):

Launch Site	Clearance Area
LF-02	3N-14N
LF-05	3N-14N

9.2. Offshore Surface. Clearance of danger zones and hazard areas, including uprange impact areas, is MANDATORY.

9.3. Airspace. Clearance of non-mission essential aircraft from launch safety airspace is MANDATORY.

9.4. Surveillance. A surveillance helicopter is REQUIRED. The UPRR Trainmaster is REQUIRED. NAWC boat support is REQUIRED.

9.5. Recovery. Not required.

10.0. Data Requirements. All items are REQUIRED. See Table 10.1, Data Requirements.

Table 10.1. Data Requirements.

Data Item	Title	Data	Deliver
380.00	Post Launch Analysis Of Radar Systems, Letter Report	PLARS Report	17 WD
401.00	Video Cassette Recording	Format: SVHS (DVD is DESIRED) Time: T-90 seconds - LOV Video: Composite of Program, Back Az, LA-24, Santa Ynez Audio: Ch 1 MFCO Safety Net; Ch 2 IRIG-B	3 WD
416.00	Single Channel Voice Recording	Voice-operated MFCO communications (Compact Disc)	On Request
927.00	Events Display Recording – Range Safety	MFCC MFCO Stripchart Recorders 1 & 2	30 Minutes
928.00	Events Display Recording – Flight Safety	MFCC RSTS Stripchart Recorders 1 & 2	30 Minutes

TABLE 3.2. PEACEKEEPER RSTS FSPO STRIPCHART SETUP SHEET

FSPO-1FSPO-2

Channel No.	Description	Type	Range Low	Range High	Channel No.	Description	Type	Range Low	Range High
1 SYNC	FRAME SYNC	S	0 OFF	1 ON	1 SYNC	FRAME SYNC	S	0 OFF	1 ON
2 E7008	CR #1 AGC VOLTS	A	0 Volts	5 Volts	2 E7008	CR #1 AGC VOLTS	A	0 Volts	5 Volts
3 E7002	FSS BUS A VOLTS	A	27 Volts	32 Volts	3 E7002	FSS BUS A VOLTS	A	27 Volts	32 Volts
4 X7005	CR #1 DESTRUCT	D	0	1	4 X7005	CR #1 DESTRUCT	D	0	1
5 X7003	CR #1 ARM	D	0	1	5 X7003	CR #1 ARM	D	0	1
6 X7007	CR #1 CHECK	D	0	1	6 X7007	CR #1 CHECK	D	0	1
7 I7003	FSS BATT A AMP	A	0 Amps	1.3 Amps	7 I7003	FSS BATT A AMP	A	0 Amps	1.3 Amps
8					8				
9 E7005	CR #2 AGC VOLTS	A	0 Volts	5 Volts	9 E7005	CR #2 AGC VOLTS	A	0 Volts	5 Volts
10 E7003	FSS BUS B VOLTS	A	27 Volts	32 Volts	10 E7003	FSS BUS B VOLTS	A	27 Volts	32 Volts
11 X7006	CR #2 DESTRUCT	D	0	1	11 X7006	CR #2 DESTRUCT	D	0	1
12 X7004	CR #2 ARM	D	0	1	12 X7004	CR #2 ARM	D	0	1
13 X7008	CR #2 CHECK	D	0	1	13 X7008	CR #2 CHECK	D	0	1
14 I7004	FSS BATT B AMP	A	0 Amps	1.3 Amps	14 I7004	FSS BATT B AMP	A	0 Amps	1.3 Amps
15					15				
16 E1017	STG 1 FU-A	A	0 Volts	5.08 Volts	16 E3008	STG 3 FU-A	A	0 Volts	5.08 Volts
17 E1017C	STG 1 FU-A INHIBIT	A	0 Volts	3.6 Volts	17 E3008C	STG 3 FU-A INHIBIT	A	0 Volts	3.6 Volts
18 E1017B	STG 1 FU-A HIGH V	A	0 Volts	3.5 Volts	18 E3008B	STG 3 FU-A HIGH V	A	0 Volts	3.5 Volts
19 E1018	STG 1 FU-B	A	0 Volts	5.08 Volts	19 E3009	STG 3 FU-B	A	0 Volts	5.08 Volts
20 E1018C	STG 1 FU-B INHIBIT	A	0 Volts	3.6 Volts	20 E3009C	STG 3 FU-B INHIBIT	A	0 Volts	3.6 Volts
21 E1018B	STG 1 FU-B HIGH V	A	0 Volts	3.5 Volts	21 E3009B	STG 3 FU-B HIGH V	A	0 Volts	3.5 Volts
22					22				
23 E2017	STG 2 FU-A	A	0 Volts	5.08 Volts	23 E4009	STG 4 FU-A	A	0 Volts	5.08 Volts
24 E2017C	STG 2 FU-A INHIBIT	A	0 Volts	3.6 Volts	24 E4009C	STG 4 FU-A INHIBIT	A	0 Volts	3.6 Volts
25 E2017B	STG 2 FU-A HIGH V	A	0 Volts	3.5 Volts	25 E4009B	STG 4 FU-A HIGH V	A	0 Volts	3.5 Volts
26 E2018	STG 2 FU-B	A	0 Volts	5.08 Volts	26 E4010	STG 4 FU-B	A	0 Volts	5.08 Volts
27 E2018C	STG 2 FU-B INHIBIT	A	0 Volts	3.6 Volts	27 E4010C	STG 4 FU-B INHIBIT	A	0 Volts	3.6 Volts
28 E2018B	STG 2 FU-B HIGH V	A	0 Volts	3.5 Volts	28 E4010B	STG 4 FU-B HIGH V	A	0 Volts	3.5 Volts
29					29 E7011	PPU. DMS BUS #1 V	A	27 Volts	32 Volts
30 L7003	MU FRAME ID	A	0 BITS	7 BITS	30 L7003	MU FRAME ID	A	0 BITS	7 BITS
31 I7002	XPONDER BATT	A	0 Amps	1.8 Amps	31 E7004	XPONDER BATT V	A	27 Volts	32 Volts
32	TIMING	IRIG A			32	TIMING	IRIG A		

TABLE 3.3. PEACEKEEPER RSTS DISPLAY EXAMPLES

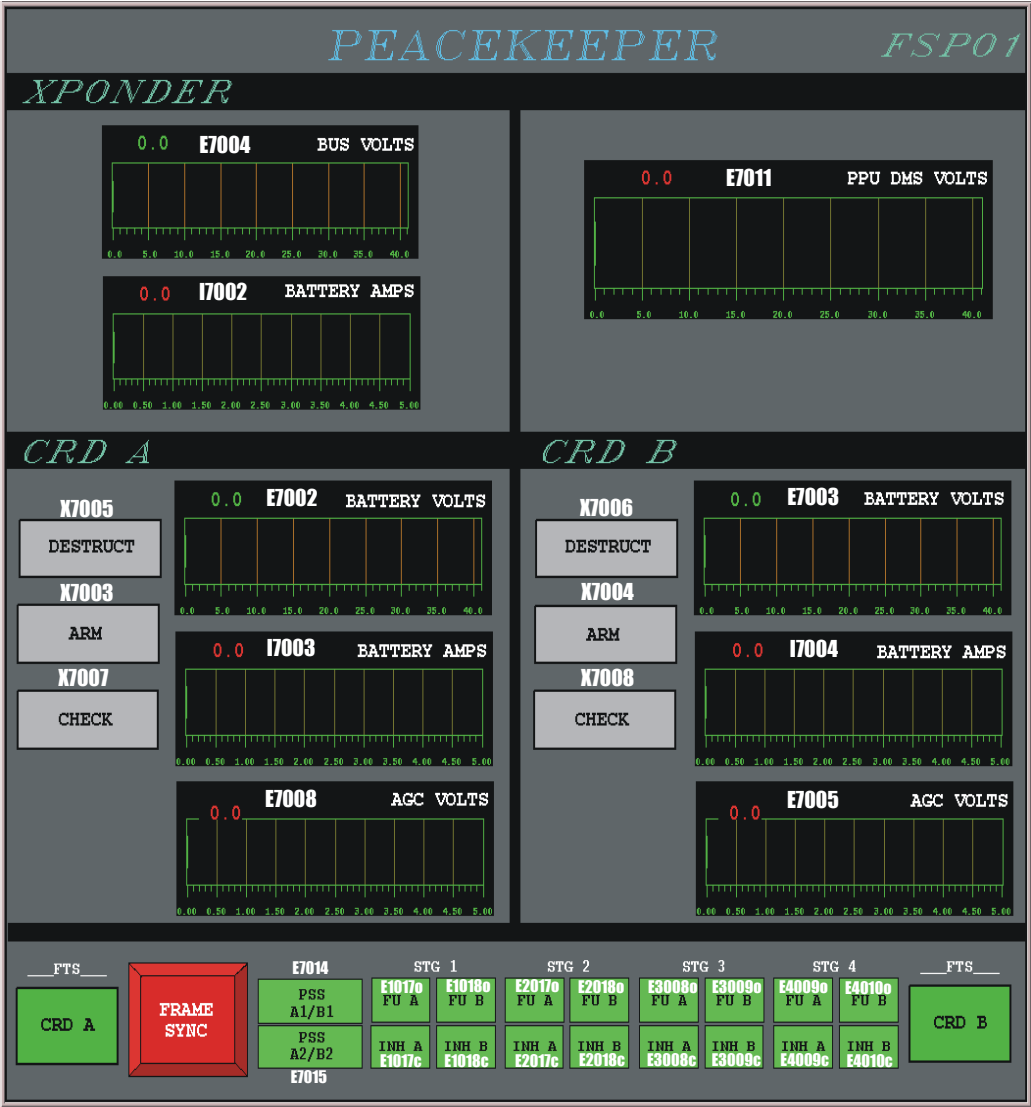


TABLE 3.3. PEACEKEEPER RSTS DISPLAY EXAMPLES – CONTINUED



TABLE 3.4. PEACEKEEPER RSTS LIMITS

Measure- ment ID	MEASUREMENT DESCRIPTION	Data Type	Reso- lution	Units	Display Range		Limit Checking				Latching State
							YELLOW		RED		
E7004	XPONDER BUS VOLT	FLOAT	3.2	VOLT	0.0	41.0	< 28.0		< 23.0		
E7011	PPU DMS BUS #1	FLOAT	3.2	VOLT	0.0	41.0			< 5.0		
I7002	XPONDER BAT CURR	FLOAT	3.2	AMPS	0.0	41.0					
E7002	FSS BUS A BATT	FLOAT	3.2	VOLT	0.0	41.0					
E7003	FSS BUS B BATT	FLOAT	3.2	VOLT	0.0	41.0					
I7003	FSS BATT A CURR	FLOAT	3.2	AMPS	0.0	5.0			< 0.5		
I7004	FSS BATT B CURR	FLOAT	3.2	AMPS	0.0	5.0			< 0.5		
E7008	CMD RCVR 1 AGC	FLOAT	3.2	VOLTS	0.0	5.0			< 1.0		
E7005	CMD RCVR 2 AGC	FLOAT	3.2	VOLTS	0.0	5.0			< 1.0		
E1017	STAGE 1 FU A	FLOAT	3.2	VOLTS	VOLTS	30.0					
E10100	STG 1 BU A MON	FLOAT	3.2	VOLTS	VOLTS	30.0					
E1010A	STG 1 BU A REF	FLOAT	3.2	VOLTS	VOLTS	30.0					
E1010B	STG 1 BU A HI VOLT	FLOAT	3.2	VOLTS	VOLTS	30.0					
E1010C	STG 1 BU A INHIB	FLOAT	3.2	VOLTS	VOLTS	30.0					
E1018	STAGE 1 FU B	FLOAT	3.2	VOLTS	0.0	30.0					
E10180	STG 1 BU B MON	FLOAT	3.2	VOLTS	0.0	30.0					
E1018A	STG 1 BU B REF	FLOAT	3.2	VOLTS	0.0	30.0					
E1018B	STG 1 BU B HI VOLT	FLOAT	3.2	VOLTS	0.0	30.0					
E1018C	STG 1 BU B INHIB	FLOAT	3.2	VOLTS	0.0	30.0					
E2017	STAGE 2 FU A	FLOAT	3.2	VOLTS	0.0	30.0					
E20170	STG 2 BU 2 MON	FLOAT	3.2	VOLTS	0.0	30.0					
E2017A	STG 2 BU 2 REF	FLOAT	3.2	VOLTS	0.0	30.0					
E2017B	STG 2 BU 2 HI VOLT	FLOAT	3.2	VOLTS	0.0	30.0					
E2017C	STG 2 BU 2 INHIB	FLOAT	3.2	VOLTS	0.0	30.0					
E2018	STAGE 2 FU B	FLOAT	3.2	VOLTS	0.0	30.0					
E20180	STG24 BU B MON	FLOAT	3.2	VOLTS	0.0	30.0					
E2018A	STG 2 BU B REF	FLOAT	3.2	VOLTS	0.0	30.0					
E2018B	STG 2 BU B HI VOLT	FLOAT	3.2	VOLTS	0.0	30.0					
E2018C	STG 2 BU B INHIB	FLOAT	3.2	VOLTS	0.0	30.0					

TABLE 3.4. PEACEKEEPER RSTS LIMITS – CONTINUED

Measure- ment ID	MEASUREMENT DESCRIPTION	Data Type	Reso- lution	Units	Display Range		Limit Checking				Latching State
							YELLOW		RED		
E3008	STAGE 3 FU A	FLOAT	3.2	VOLTS	0.0	30.0					
E30080	STG 3 BU AB MON	FLOAT	3.2	VOLTS	0.0	30.0					
E3008A	STG 3 BU A REF	FLOAT	3.2	VOLTS	0.0	30.0					
E3008B	STG 3 BU A HI VOLT	FLOAT	3.2	VOLTS	0.0	30.0					
E3008C	STG 3 BU A INHIB	FLOAT	3.2	VOLTS	0.0	30.0					
E3009	STAGE 3 FU B	FLOAT	3.2	VOLTS	0.0	30.0					
E30090	STG 3 BU B MON	FLOAT	3.2	VOLTS	0.0	30.0					
E3009A	STG 3 BU B REF	FLOAT	3.2	VOLTS	0.0	30.0					
E3009B	STG 3 BU B HI VOLT	FLOAT	3.2	VOLTS	0.0	30.0					
E3009C	STG 3 BU B INHIB	FLOAT	3.2	VOLTS	0.0	30.0					
E4009	STAGE 4 FU A	FLOAT	3.2	VOLTS	0.0	30.0					
E40090	STG 4 BUA MON	FLOAT	3.2	VOLTS	0.0	30.0					
E4009A	STG 4 BU A REF	FLOAT	3.2	VOLTS	0.0	30.0					
E4009B	STG 4 BU A HI VOLT	FLOAT	3.2	VOLTS	0.0	30.0					
E4009C	STG 4 BU A INHIB	FLOAT	3.2	VOLTS	0.0	30.0					
E4010	STAGE 4 BU B	FLOAT	3.2	VOLTS	0.0	30.0					
E40100	STG 4 BU B MON	FLOAT	3.2	VOLTS	0.0	30.0					
E4010A	STG 4 BU B REF	FLOAT	3.2	VOLTS	0.0	30.0					
E4010B	STG 4 BU B HI VOLT	FLOAT	3.2	VOLTS	0.0	30.0					
E4010C	STG 4 BU B INHIB	FLOAT	3.2	VOLTS	0.0	30.0					

TABLE 3.5. PEACEKEEPER RSTS LATCHING

Measure- ment ID	MEASUREMENT DESCRIPTION	Data Type	Display Color		Display Text		Latching State
			OFF	ON	OFF	ON	
X7005	CMD RCVR 1 DESTRUCT	STATE	GRAY	RED	DESTRUCT	DESTRUCT	
X7006	CMD RCVR 2 DESTRUCT	STATE	GRAY	RED	DESTRUCT	DESTRUCT	
X7003	CMD RCVR 1 ARM	STATE	GRAY	RED	ARM	ARM	
X7004	CMD RCVR 2 ARM	STATE	GRAY	RED	ARM	ARM	
X7007	CMD RCVR 1 CHK CH4	STATE	GRAY	GREEN	CHECK	CHECK	
X7008	CMD RCVR 2 CHK CH4	STATE	GRAY	GREEN	CHECK	CHECK	

TABLE 3.6. PEACEKEEPER RSTS GREEN BOARD MEASUREMENT LIST

CRD A	FRAME SYNC	PSS A1/B1	STAGE 1		STAGE 2		STAGE 3		STAGE 4		CRD B
			FU A	FU B	FU A	FU B	FU A	FU B	FU A	FU B	
X7005		E7014	E1017B	E1018B	E2017B	E2018B	E3008B	E3009B	E4009B	E4010B	X7006
X7003			E1017C	E1018C	E2017C	E2018C	E3008C	E3009C	E4009C	E4010C	X7004
X7007	(RESET)	PSS A2/B2	E1017D	E1018D	E2017D	E2018D	E3008D	E3009D	E4009D	E4010D	X7008
E7002											E7003
I7003											I7004
E7008		E7015	INH A	INH B	INH A	INH B	INH A	INH B	INH A	INH B	E7005
			E1017C	E1018C	E2017C	E2018C	E3008C	E3009C	E4009C	E4010C	

NOTE: Measurements are logically “anded.” All measurements must be within tolerance or in a state that signifies a green condition.

TABLE 8.1. PEACEKEEPER ATMOSPHERIC DATA REQUIREMENTS

Assessment	Atmospheric Parameters	Development Time by 30 WS	Data Sent to FSA	FSA Analysis Complete	Requirement
1. L-1 day debris risk	T-0 forecast of wind speed and direction, 0-60,000 ft	N/A	N/A	N/A	NR
2. L-1 day toxic risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-10,000 ft	N/A	N/A	N/A	NR
3. L-1 day overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A	N/A	N/A	NR
4. RSDS display	Observed wind speed and direction, 0-60,000 ft (met input sent to ROMSSC)	T-8 to T-4:45 hr	Update complete by T-3 hr		R
5. Pre-launch debris risk	Observed wind speed and direction, 0-60,000 ft	T-8 to T-5 hr (NLT T-6 hr) T-4 to T-1:30 hr (NLT T-2:30 hr)	T-4:30 hr T-1 hr	T-3 hr T-30 min	M M
6. Pre-launch toxic risk	T-0 forecast of wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling and cloud sky coverage for 0-10,000 ft	T-4:30 to T-2:30 hr T-3:30 to T-1:30 hr (all valid T-0 to T+1 hr)	T-2:30 hr T-1:30 hr	T-1:45 hr T-:45 min	R M
7. Pre-launch overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A	N/A	N/A	NR
8. Liftoff toxic hazard	Same as box 6	<u>Developed</u> T-1:30 hr to T-10 min	<u>Valid</u> T-0 to T+10 min	<u>To FSA</u> T-10 min	T-2 mins R
9. Launch delay toxic risk (launch windows 60 min or longer)	Same as box 6; valid for 60 min intervals	<u>Developed</u> T-1:30 hr to T-0 T+30 min to T+1:30 hr T+1:00 to T+2:30 hr ... T+3:30 to T+4:30 hr	<u>Valid</u> T+1 to T+2 hr T+2 to T+3 hr T+3 to T+4hr ... T+5 to T+6 hr	<u>To FSA</u> T+30 min T+1:30 hr T+2:30 hr ... T+5:30 hr	30 min after receipt of data M
10. Cat abort toxic hazard	Same as box 6; valid for 15 min intervals	<u>Developed</u> T-0 to T+10 min T+15 to T+30 min	<u>Valid</u> T+15 min to T+30 min T+30 min to T+45 min	<u>To FSA</u> T+15 min T+30 min	ASAP after Cat Abort M
11. Re-constructed T-0 weather profile for toxic analysis	Observed wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling, cloud sky coverage and turbulence measurements for 0-10,000 ft	T-0 to T+24 hr	T+24 hr	N/A	R

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MINUTEMAN III

1.0. General. This annex specifies flight control support requirements for Minuteman III missions. After T-45 seconds the failure of a single MANDATORY range processor or display system will not cause a hold unless the item is MANDATORY for more than one requirement. All portions of the ground and airborne command systems are excluded from this special rule, as are radar and telemetry site requirements. The SMFCO may approve changes to this annex to accommodate operation-peculiar requirements.

2.0. Range Tracking Systems (RTS). Two adequate and independent instrumentation data sources from liftoff through flight control end of mission are MANDATORY.

2.1. Radar. Radars supporting a MANDATORY requirement must be capable of tracking in both skin and transponder modes. A radar slaving source is REQUIRED.

2.1.1. Local. One Vandenberg AFB radar with RF visibility to the launch site and ability to provide quality on-target track of either the booster or transponder no later than three (3) seconds prior to minimum time to endanger (MTE-3 sec) is MANDATORY for liftoff. Data from liftoff is REQUIRED. A second Vandenberg AFB radar is REQUIRED for liftoff.

2.1.2. Remote. One remote radar (downrange and/or crossrange from Vandenberg AFB) is MANDATORY for liftoff.

2.1.3. TNAR Filter. Radar inputs to create an adequate TNAR filter solution are MANDATORY. Two geographically diverse radars with transponder mode range-rate capability are MANDATORY. One non-geographically diverse radar with transponder mode range-rate capability is REQUIRED. Specific radars, to include midrange radars, may be designated to support the filter on a mission-by-mission basis, based upon flight analysis. 30 SW/SEY is the OPR for this determination.

2.2. Transponder. A trackable coherent C-band transponder on the launch vehicle is MANDATORY.

2.3. Telemetered Inertial Guidance (TMIG). One string of TMIG is MANDATORY and a second string is REQUIRED.

2.4. Global Positioning System (GPS). The use of a GPS translator or receiver shall be considered on a case-by-case basis until adequate experience has been gained to define these requirements. If flown, one string of GPS present position and IIP data is REQUIRED.

3.0. Telemetry. Receipt of telemetered data from the first FTS turn-on through flight control EOM is MANDATORY. One Vandenberg AFB TM site is MANDATORY and one TM site is MANDATORY. A telemetry slaving source is REQUIRED.

4.0. Command. The capture of the CRDs from turn on through flight control EOM is MANDATORY.

4.1. Command systems. A centrally controlled command processing system is MANDATORY. Configure CCS modes as follows:

CCS Mode	Configuration
Operational	Single Non-Redundant
Support	Standard
Failure	Dual

4.2. Command transmitters. Two Vandenberg AFB command transmitters with directional and omni-directional antennas and RF visibility to the launch site are MANDATORY. Two remote transmitters (downrange and/or crossrange from Vandenberg AFB) with directional antennas are MANDATORY. Power must be supplied to the MANDATORY command transmitters in such a way so that the loss of a single source of power will not disable both transmitters. Elevation of the directional antennas will not be less than three degrees unless directed by the MFCO. Carrier frequency is 416.5 MHz with +/- 30 kHz deviation per tone, Expanded Mode, Monitor 4. Initiate prime CCT switches from local to remote transmitter at T+55 seconds. Initiate local omni to directional antenna switch at T+60 seconds.

4.3. Command slaving source. A real-time slaving source is MANDATORY for the directional antenna at each remote command transmitter site prime for supporting the MANDATORY command transmitter requirement. A real-time slaving source is REQUIRED for the directional antennas for the prime local transmitters.

4.4. Command failover. Automatic failover capability connecting all supporting command transmitters is MANDATORY.

4.5. Flight termination system (FTS). A redundant launch vehicle FTS is MANDATORY.

5.0. Displays. The continuous real-time display of launch vehicle performance and system status that affects flight safety is MANDATORY.

5.1. Tracking Display. Two complete Range Safety Display Systems (RSDS) are MANDATORY. Each string will consist of one MANDATORY and one REQUIRED display for the MFCO and one MANDATORY and one REQUIRED display for the RTDC. Display markers for support aircraft, seacraft, oil platforms and unsheltered launch area personnel are REQUIRED. A mission continuation display is REQUIRED.

5.2. MFCO Stripchart Display. Two stripchart recorders are REQUIRED. MFCC stripchart recorder console lights are REQUIRED. Configure the red and green lights above each MFCC stripchart recorder such that the green lights are illuminated when the telemetry bit stream is in sync and the red lights are illuminated when the bit stream is out of sync. For Minuteman III NS-20 missions, the configure indicator lights to display computer malfunction (CM') on console #1 and

guidance shutdown (KT') on console #2. MFCC stripchart recorders should be configured for best source display. Configure each stripchart recorder channel for full-scale data display.

5.2.1. Chamber Pressure. Booster chamber pressure telemetry for each engine is REQUIRED. Chamber pressure channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.2. Steering. Vehicle steering (yaw, pitch, roll) is REQUIRED. Steering channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.3. Automatic Gain Control (AGC). Command Receiver Decoder (CRD) AGC levels are REQUIRED. AGC assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

Table 5.1. MFCC Stripchart Recorder Channel Assignments (NS-20A & NS-50A).

Recorder #1

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/1	Stage 1 Chamber Pressure	R
2/2	Stage 2 Chamber Pressure	R
3/3	Stage 3 Chamber Pressure	R
4/4	Yaw Rate	R
5/5	Pitch Rate	R
6/6	Roll Rate	R
7/7	AGC Command Receiver 1	R
8/8	AGC Command Receiver 2	R
EVENT/9	TLM Sync (NS-50)	R
EVENT/9	CM' (NS-20)	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

Recorder #2

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/10	TM Synchronization	R
2/11	PBV Fuel Manifold Pressure	R
3/12	Yaw Rate	R
4/13	Pitch Rate	R
5/14	Roll Rate	R
6/15	PBV Axial Chamber Pressure	R
7/16	AGC Command Receiver 1	R
8/17	AGC Command Receiver 2	R
EVENT/18	TLM Sync (NS-50)	R
EVENT/18	KT' (NS-20)	R

EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

5.3. FSPO Display. A real-time Range Safety telemetry display for the FSPO, capable of providing data until flight control EOM, is MANDATORY. FSPO display requirements are specified in Table 5.2, FSPO Display Locations & Requirements. RSTS FSPO console data display requirements are specified in Tables 3.4 through 3.11 at the end of this annex. A redundant RSTS console is DESIRED.

Table 5.2. FSPO Display Locations & Requirements.

Blockhouse		RSTS Display		RSTS Stripchart		QLDA-7 W/S	
T-0	Flight	T-0	Flight	T-0	Flight	T-0	Flight
M	N/C	R	R	M	M	D	D

5.4. Command Status Display. A MFCO status panel is MANDATORY for each active centrally controlled command processing system.

5.5. Attitude Display. Not required.

5.6. Mission Discrete Indicators (MDIs). MDIs are REQUIRED. Indication of guidance shutdown on two of two strings of RSDS is REQUIRED. MDI assignments are specified in Table 5.3, Mission Discrete Indicator Assignments (NS-20A) and Table 5.3, Mission Discrete Indicator Assignments (NS-50A).

Table 5.3. Mission Discrete Indicator Assignments (NS-20A).

<u>Parameter</u>	<u>Display</u>	<u>Display Color</u>	<u>Requirement</u>
TM Synchronization	SYNC	Red	R
Terminal Countdown Entry	TCD	Green	R
IMU Power Fault	IMU	Red	R
Gyro Fault	GDER	Red	R
Thrust Termination	TT	Green	R
PBV Shutdown	KTPRI	Green	R
Tone 4 Monitor, Receiver 1	TONE1	Red	R
Tone 4 Monitor, Receiver 2	TONE2	Red	R

Table 5.3. Mission Discrete Indicator Assignments (NS-50A).

<u>Parameter</u>	<u>Display</u>	<u>Display Color</u>	<u>Requirement</u>
TM Synchronization	SYNC	Red	R
Terminal Countdown Entry	TCD	Green	R
IMU Power Fault	IMU	Red	R
Thrust Termination	TT	Green	R

PBV Shutdown	CS	Green	R
PBV Shutdown Confirmed	NULL	Green	R
Tone 4 Monitor, Receiver 1	TONE1	Red	R
Tone 4 Monitor, Receiver 2	TONE2	Red	R

6.0. Communications.

6.1. Voice Communications. MFCO voice communications are restricted from monitor access by agencies outside 30 SW/SE without written permission.

6.1.1. MFCO Voice Circuits. The MANDATORY and REQUIRED voice networks (nets) and voice direct lines (VDL) listed in Table 6.1, MFCO Voice Circuit Requirements, describe the voice circuit requirements at the MFCO-1 and MFCO-2 consoles. Access by all positions on the MFCO Safety Net is MANDATORY and each position will have talk and continuous monitor capability. RTS Range Safety Officer is added to REQUIRED Range Safety Net. Table 6.2, RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements, describes the voice circuit requirements at the RSTS-1 and RSTS-2 consoles.

Table 6.1. MFCO Voice Circuit Requirements

Comm Circuit	Requirement	Comm Circuit	Requirement
MFCO Safety Net	M	RSTS FSPO*	R
Countdown Net	M	OSM*	R
CCT-1 Net	M	LST*	R
Safety Engineering Net	R	Program*	R
Range Safety Net	R	Back Az*	R
CCT-2 Net	R	ROC	R
Emergency Net	R	RCO	R
SCMDR Conf Net	R	ACO*	R
Safety Radio Net	R	LWO	R
Weather Conf Net	R	DCO	R
MFCO-1 (at MFCO-2)*	R	MCS/MC	R
MFCO-2 (at MFCO-1)*	R	SCMDR	R
CMD-1*	R	OD	R
CMD-2*	R	SE	R
RTDC-1*	R	Command Post	R
RTDC-2*	R	Launch Director	R
TMO*	R	MCO	R
FSPO*	R	Class A Line	R

* - Indicates positions with full MFCO Safety Net access.

Table 6.2. RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements

Comm Circuit	RSTS FSPO	RSTS QLDA-7
MFCO Safety Net	M	D (Monitor)
Countdown Net	M	D
Safety Engineering Net	R	-
CCT-1 Net	R	-
CCT-2 Net	R	-
Weather Conf Net	R	-
S/MFCO	R	-
FSPO	R	D
RSTS FSPO	-	D
RCO	R	-
SE	R	-
Class A Line	R	D

6.1.2. Provide one MANDATORY and two REQUIRED Class A telephone lines and one telephone for the Flight Safety Analyst workstation in the MFCC. A Class A telephone line between the MFCC Toxic Analyst workstation and DC-90 is MANDATORY. Access to a secure telephone in the MFCC is REQUIRED.

6.1.3. LST Communications. The MANDATORY and REQUIRED communication circuits listed in Table 6.3, LST Fallback Communication Access Requirements, will be provided at Fallback 21 for all launches utilizing either LF-04 or LF-10 and Fallback 22 for all launches utilizing either LF-09 or LF-26. This communication capability will be available from an outdoor location at each Fallback. Additionally, this communication capability will be provided within the mobile command post vehicle (if available).

Table 6.3. LST Fallback Communication Access Requirements.

Comm Circuit	Requirement
MFCO Safety Net (T/M)	M
Countdown Net (M)	R
MFCO VDL	R
OSM VDL	R
ACO VDL	R
DCG VDL (Bldg 11165)	R
Class A Line	R

T = Talk capability

M = Monitor

6.1.4. ISB Communications. Range Safety Net and Countdown Net monitors are REQUIRED. A Class A administrative telephone is REQUIRED. Range countdown clock is REQUIRED. CCTV capability is REQUIRED.

6.2. Status/Alert (S&A) System. Status/Alert modules are REQUIRED at each MFCO console from the following positions: OSM, ACO, CMD-1, CMD-2, RTDC-1, RTDC-2, FSPO and RSTS FSPO.

6.3. Closed Circuit Television (CCTV). The following five (simultaneous) displays are REQUIRED on each MFCO console: Program TV, Back Az TV, Boat Plot, ADS and one long-range optic source. Available long-range optic sources may be split between each MFCO position. Best source video is REQUIRED at the ISB post.

6.4. Optics. One long-range optic source is REQUIRED. Two launch area video cameras, identified as Program and Back Az, are REQUIRED. Television van support locations for Program and Back Az are as follows:

Launch Site	Program Site	Back Az Site
LF-04	JB 13*	JB 101
LF-09	JB 203	JB 78*
LF-10	JB 101*	JB 86*
LF-26	JB 89A*	JB 81

* - Indicates visibility to the launch pad

6.5. Missile Lift-off Signal. A positive lift-off indication is REQUIRED.

6.6. Command Communications. The data transmission link between each CCT and the central command system will consist of two MANDATORY and two REQUIRED complete and independent duplex command and status circuits as well as one MANDATORY and one REQUIRED complete and independent duplex pointing data circuits.

6.7. Range Communication.

6.7.1. All mission essential personnel located inside the Impact Limit Line (ILL) will have means to communicate with their control centers and the LST.

6.7.2. The ability to “breakaway” from a launch vehicle anomaly when directed for all supporting aircraft whose Test Support Point (TSP) lies within the ILL is MANDATORY. The ability to receive this communication is REQUIRED. If this communication capability is lost, "no-radio" (NORDO) procedures will be implemented, which shall include a return to base procedure to avoid closed airspace (impact boxes and up range hazard and caution areas).

6.8. Clocks. Visibility by all console positions within the Mission Flight Control Center (MFCC) to UTC, range countdown and pad clocks is REQUIRED.

7.0. Data Processing. The systems that process metric and telemetry data for output to MFCC displays are at the same level of decision authority as are required for the data to be displayed. Processing and transfer of weather data to MFCC systems are required at the levels of decision authority as specified in Appendix D, Minuteman III Weather System and Instrumentation Support Plan.

8.0. Meteorological. Receipt of weather data is MANDATORY and/or REQUIRED, as specified in Table 8.1, Minuteman III Atmospheric Data Requirements.

8.1. Local Atmospheric Data. See Table 8.1, Minuteman III Atmospheric Data Requirements.

8.2. Launch Commit Criteria. The Weather Aircraft is REQUIRED. Launch will not occur if weather conditions violate MANDATORY safety constraints for natural and triggered lightning, or triboelectrification, as described in Appendix C, Range Safety Weather Launch Commit Criteria.

8.3. Post Operation. See Table 8.1, Minuteman III Atmospheric Data Requirements.

9.0. Area Clearance. Clearance of all non-mission essential personnel from areas under 30 SW surveillance and control is MANDATORY.

9.1. On-shore Surface. Clearance of all non-mission essential personnel from land areas within the ILL, including the Union Pacific Railroad (UPRR) right-of-way, is MANDATORY. UPRR clearance is as follows (subject to day-of-launch real-time analysis):

Launch Site	Clearance Area
LF-04	3N-14N
LF-09	None*
LF-10	3N-14N
LF-26	None*

* - UPRR Trainmaster will support

9.2. Offshore Surface. Clearance of danger zones and hazard areas, including uprange impact areas, is MANDATORY.

9.3. Airspace. Clearance of non-mission essential aircraft from launch safety airspace is MANDATORY.

9.4. Surveillance. A surveillance helicopter is REQUIRED. The UPRR Trainmaster is REQUIRED. NAWC boat support is REQUIRED.

9.5. Recovery. Not required.

10.0. Data Requirements. All items are REQUIRED. See Table 10.1, Data Requirements.

Table 10.1. Data Requirements.

Data Item	Title	Data	Deliver
380.00	Post Launch Analysis Of Radar Systems, Letter Report	PLARS Report	17 WD
401.00	Video Cassette Recording	Format: SVHS (DVD is DESIRED) Time: T-90 seconds - LOV Video: Composite of Program, Back Az, LA-24, Santa Ynez Audio: Ch 1 MFCO Safety Net; Ch 2 IRIG-B	3 WD
416.00	Single Channel Voice Recording	Voice-operated MFCO communications (Compact Disc)	On Request
927.00	Events Display Recording – Range Safety	MFCC MFCO Stripchart Recorders 1 & 2	30 Minutes
928.00	Events Display Recording – Flight Safety	MFCC RSTS Stripchart Recorders 1 & 2	30 Minutes

TABLE 3.2. MINUTEMAN III (NS-20A) RSTS FSPO STRIPCHART SETUP SHEET

FSPO-1FSPO-2

Channel No.	Description	Type	Range Low	Range High	Channel No.	Description	Type	Range Low	Range High
1 SYNC	FRAME SYNC	S	0 OFF	1 ON	1 SYNC	FRAME SYNC	S	0 OFF	1 ON
2 EIO03	AGC A	A	-112.4 DBM	-41 DBM	2 EIO03	AGC A	A	-112.4 DBM	-41 DBM
3 EIO05	CK 4 A	A	0 Volts	5 Volts	3 EIO05	CK 4 A	A	0 Volts	5 Volts
4 XIO01	DESTRUCT A	A	0 Volts	5 Volts	4 XIO01	DESTRUCT A	A	0 Volts	5 Volts
5 EIO01	CRD A BATT	A	20.00 Volts	32.00 Volts	5 EIO01	CRD A BATT	A	20.00 Volts	32.00 Volts
6 EIO04	AGC B	A	-112.4 DBM	-41 DBM	6 EIO04	AGC B	A	-112.4 DBM	-41 DBM
7 EIO06	CK 4 B	A	0 Volts	5 Volts	7 EIO06	CK 4 B	A	0 Volts	5 Volts
8 XIO02	DESTRUCT B	A	0 Volts	5 Volts	8 XIO02	DESTRUCT B	A	0 Volts	5 Volts
9 EIO02	CRD B BATT	A	20.00 Volts	32.00 Volts	9 EIO02	CRD B BATT	A	20.00 Volts	32.00 Volts
10 MIM06	XPONDER BATT	A	0 Volts	34.79 Volts	10 MIM06	XPONDER BATT	A	0 Volts	34.79 Volts
11 MIM10	XPONDER SIG	A	0 Volts	5 Volts	11 MIM10	XPONDER SIG	A	0 Volts	5 Volts
12 IIM10	PCM BATT VOLTS	A	0 Volts	34.79 Volts	12 IIM10	PCM BATT VOLTS	A	0 Volts	34.79 Volts
13					13				
14					14				
15					15				
16					16				
17					17				
18					18				
19					19				
20					20				
21					21				
22					22				
23					23				
24					24				
25					25				
26					26				
27					27				
28					28				
29					29				
30					30				
31					31				
32	TIMING	IRIG B			32	TIMING	IRIG B		

Range High = 250 Counts = 100% Full Scale

TABLE 3.3. MINUTEMAN III (NS-50A) RSTS FSPO STRIPCHART SETUP SHEET

FSPO-1FSPO-2

Channel No.	Description	Type	Range Low	Range High	Channel No.	Description	Type	Range Low	Range High
1	SYNC	S	0 OFF	1 ON	1	SYNC	S	0 OFF	1 ON
2	EIO03	A	-112.4 DBM	-41 DBM	2	EIO03	A	-112.4 DBM	-41 DBM
3	EIO05	A	0 Volts	5 Volts	3	EIO05	A	0 Volts	5 Volts
4	XIO01	A	0 Volts	5 Volts	4	XIO01	A	0 Volts	5 Volts
5	EIO01	A	20.00 Volts	32.00 Volts	5	EIO01	A	20.00 Volts	32.00 Volts
6	EIO04	A	-112.4 DBM	-41 DBM	6	EIO04	A	-112.4 DBM	-41 DBM
7	EIO06	A	0 Volts	5 Volts	7	EIO06	A	0 Volts	5 Volts
8	XIO02	A	0 Volts	5 Volts	8	XIO02	A	0 Volts	5 Volts
9	EIO02	A	20.00 Volts	32.00 Volts	9	EIO02	A	20.00 Volts	32.00 Volts
10	MIM06	A	0 Volts	34.79 Volts	10	MIM06	A	0 Volts	34.79 Volts
11	MIM10	A	0 Volts	5 Volts	11	MIM10	A	0 Volts	5 Volts
12	IIM10	A	0 Volts	34.79 Volts	12	IIM10	A	0 Volts	34.79 Volts
13					13				
14					14				
15					15				
16					16				
17					17				
18					18				
19					19				
20					20				
21					21				
22					22				
23					23				
24					24				
25					25				
26					26				
27					27				
28					28				
29					29				
30					30				
31					31				
32	TIMING	IRIG B			32	TIMING	IRIG B		

Range High = 250 Counts = 100% Full Scale

TABLE 3.4. MINUTEMAN III (NS-20A) RSTS DISPLAY EXAMPLE

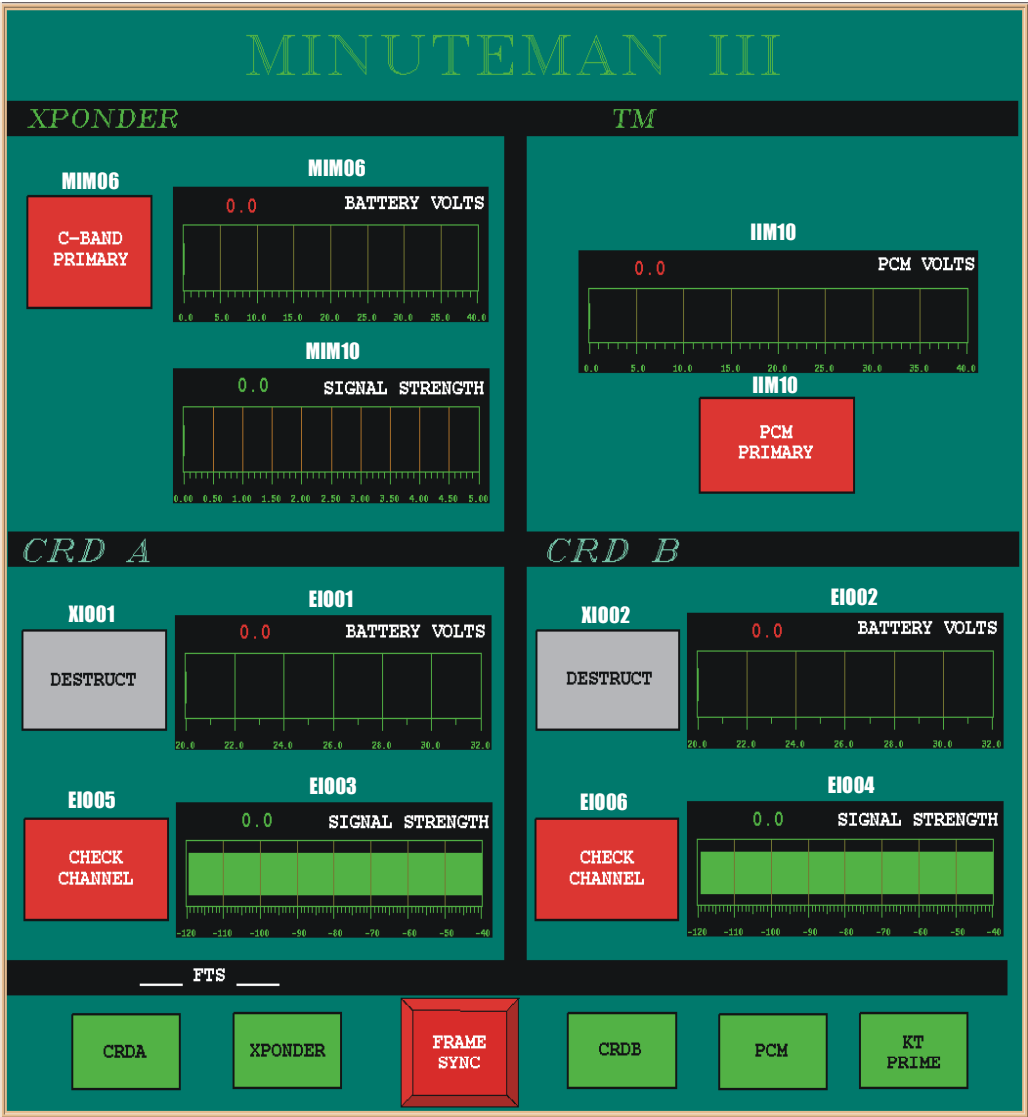


TABLE 3.5. MINUTEMAN III (NS-50A) RSTS DISPLAY EXAMPLE

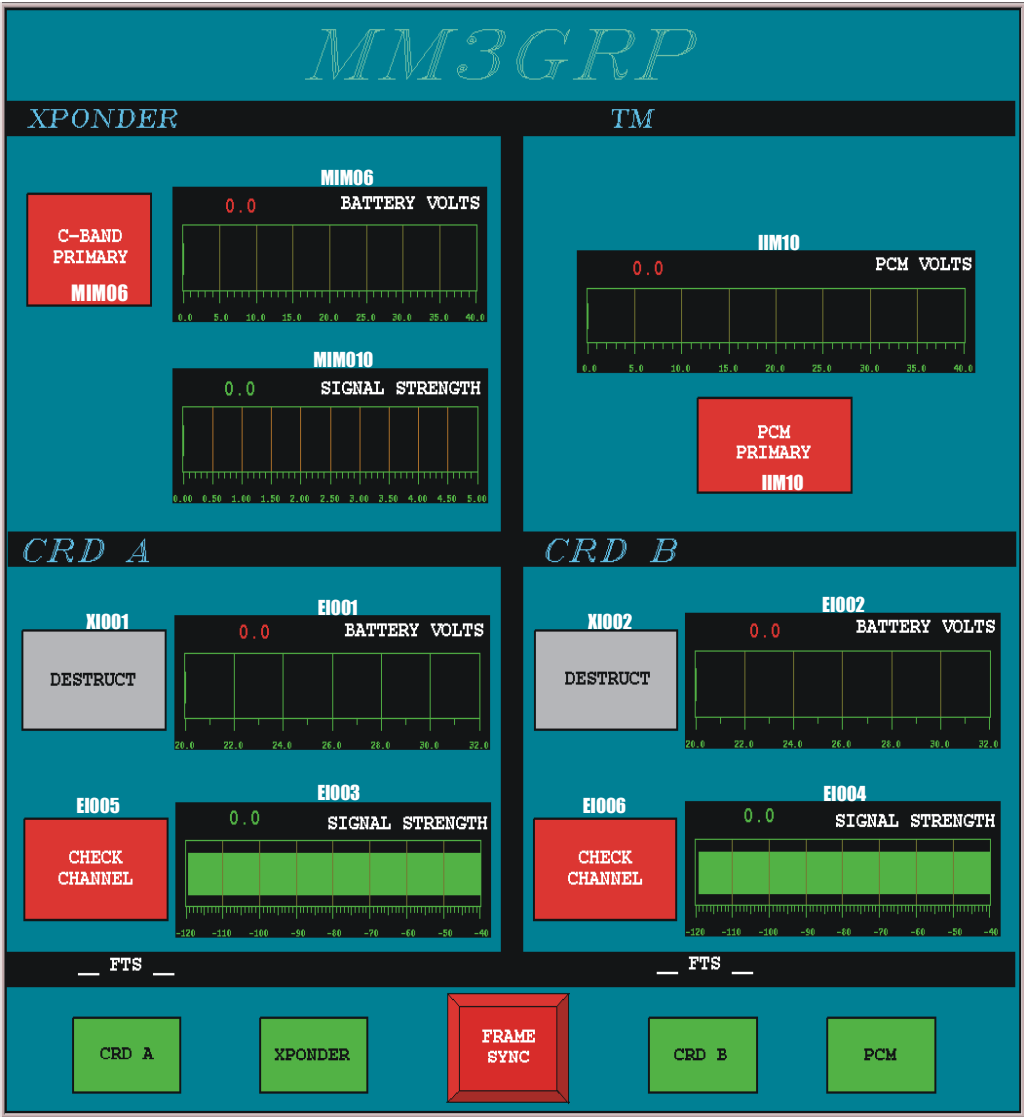


TABLE 3.6. MINUTEMAN III (NS-20A) RSTS LIMITS

MEASUREMENT ID	MEASUREMENT DESCRIPTION	Data Type	Resolution	Units	Display Range		Limit Checking				Latching State
							YELLOW		RED		
EIO01	CMD DEST A PWR	FLOAT	3.1	VDC	20.0	32.0	< 28.0		< 26.0		
EIO02	CMD DEST B PWR	FLOAT	3.1	VDC	20.0	32.0	< 28.0		< 26.0		
EIO03	CMD DEST RCVR A	FLOAT	3.1	DBM	-120.0	-40.0			< -90.0		
EIO04	CMD DEST RCVR B	FLOAT	3.1	DBM	-120.0	-40.0			< -90.0		
IIM10	PCM PRI PWR	FLOAT	3.1	VDC	0.0	40.0	< 28.0		< 27.0		
MIM06	C-BAND PWR	FLOAT	3.1	VDC	0.0	40.0	< 28.0		< 24.5		
MIM10	C-BAND S/S	FLOAT	3.1	TMVDC	0.0	5.0					
EIO05	CK CH RCVR A	EIO05	3.1	TMVDC	0	128			<= 128		
EIO06	CK CH RCVR B	EIO06	3.1	TMVDC	0	128			<= 128		

TABLE 3.7. MINUTEMAN III (NS-50A) RSTS LIMITS

MEASUREMENT ID	MEASUREMENT DESCRIPTION	Data Type	Resolution	Units	Display Range		Limit Checking				Latching State
							YELLOW		RED		
EIO01	CMD DEST A PWR	FLOAT	3.1	VDC	20.0	32.0	< 28.0		< 26.0		
EIO02	CMD DEST B PWR	FLOAT	3.1	VDC	20.0	32.0	< 28.0		< 26.0		
EIO03	CMD DEST RCVR A	FLOAT	3.1	DBM	-120.0	-40.0			< -90.0		
EIO04	CMD DEST RCVR B	FLOAT	3.1	DBM	-120.0	-40.0			< -90.0		
IIM10	PCM PRI PWR	FLOAT	3.1	VDC	0.0	40.0	< 28.0		< 27.0		
MIM06	C-BAND PWR	FLOAT	3.1	VDC	0.0	40.0	< 28.0		< 24.5		
MIM10	C-BAND S/S	FLOAT	3.1	TMVDC	0.0	5.0					
EIO05	CK CH RCVR A	EIO05	3.1	TMVDC	0	128			<= 128		
EIO06	CK CH RCVR B	EIO06	3.1	TMVDC	0	128			<= 128		

TABLE 3.8. MINUTEMAN III (NS-20A) RSTS LATCHING

Measure- ment ID	MEASUREMENT DESCRIPTION	Data Type	Display Color		Display Text		Latching State
			OFF	ON	OFF	ON	
EIO05 ¹	CK CH RCVR A	STATE	GRAY	GREEN	CK CHANNEL	CK CHANNEL	
EIO06 ¹	CK CH RCVR B	STATE	GRAY	GREEN	CH CHANNEL	CK CHANNEL	
XIO01	CMD DEST A	STATE	GRAY	RED	DESTRUCT	DESTRUCT	ON
XIO02	CMD DEST B	STATE	GRAY	RED	DESTRUCT	DESTRUCT	ON
XGH02	COMPUTE MODE KT'	STATE	GREEN	RED	KT PRIME	KT PRIME	

NOTE: ¹ Measurements need to be converted from analog to discrete <= 40 counts = zero and >= 128 counts = one.

TABLE 3.9. MINUTEMAN III (NS-50A) RSTS LATCHING

MEASUREMENT ID	MEASUREMENT DESCRIPTION	Data Type	Display Color		Display Text		Latching State
			OFF	ON	OFF	ON	
EIO05 ¹	CK CH RCVR A	STATE	GRAY	GREEN	CK CHANNEL	CK CHANNEL	
EIO06 ¹	CK CH RCVR B	STATE	GRAY	GREEN	CH CHANNEL	CK CHANNEL	
XIO01	CMD DEST A	STATE	GRAY	RED	DESTRUCT	DESTRUCT	ON
XIO02	CMD DEST B	STATE	GRAY	RED	DESTRUCT	DESTRUCT	ON

NOTE: ¹ Measurements need to be converted from analog to discrete <= 40 counts = zero and >= 128 counts = one.

TABLE 3.10. MINUTEMAN III (NS-20A) RSTS GREEN BOARD MEASUREMENT LIST

CRD A	TRANSPONDER	FRAME SYNC	CRD B	PCM	KT PRIME
XIO01	MIM06		XIO02	IIM10	XGH02
EIO05			EIO06		
EIO01		(RESET)	EIO02		
EIO03			EIO04		

NOTE: Measurements are logically “anded.” All measurements must be within tolerance or in a state that signifies a green condition.

TABLE 3.11. MINUTEMAN III (NS-50A) RSTS GREEN BOARD MEASUREMENT LIST

CRD A	TRANSPONDER	FRAME SYNC	CRD B	PCM
XIO01	MIM06		XIO02	IIM10
EIO05			EIO06	
EIO01		(RESET)	EIO02	
EIO03			EIO04	

NOTE: Measurements are logically “anded.” All measurements must be within tolerance or in a state that signifies a green condition.

TABLE 8.1. MINUTEMAN III ATMOSPHERIC DATA REQUIREMENTS

Assessment	Atmospheric Parameters	Development Time by 30 WS	Data Sent to FSA	FSA Analysis Complete	Requirement
1. L-1 day debris risk	T-0 forecast of wind speed and direction, 0-60,000 ft	N/A	N/A	N/A	NR
2. L-1 day toxic risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-10,000 ft	N/A	N/A	N/A	NR
3. L-1 day overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A	N/A	N/A	NR
4. RSDS display	Observed wind speed and direction, 0-60,000 ft (met input sent to ROMSSC)	T-8 to T-4:45 hr	Update complete by T-3 hr		R
5. Pre-launch debris risk	Observed wind speed and direction, 0-60,000 ft	T-8 to T-5 hr (NLT T-6 hr) T-4 to T-1:30 hr (NLT T-2:30 hr)	T-4:30 hr T-1 hr	T-3 hr T-30 min	M M
6. Pre-launch toxic risk	T-0 forecast of wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling and cloud sky coverage for 0-10,000 ft	T-4:30 to T-2:30 hr T-3:30 to T-1:30 hr (all valid T-0 to T+1 hr)	T-2:30 hr T-1:30 hr	T-1:45 hr T-:45 min	R M
7. Pre-launch overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A	N/A	N/A	NR
8. Liftoff toxic hazard	Same as box 6	<u>Developed</u> T-1:30 hr to T-10 min	<u>Valid</u> T-0 to T+10 min	<u>To FSA</u> T-10 min	T-2 mins R
9. Launch delay toxic risk (launch windows 60 min or longer)	Same as box 6; valid for 60 min intervals	<u>Developed</u> T-1:30 hr to T-0 T+30 min to T+1:30 hr T+1:00 to T+2:30 hr ... T+3:30 to T+4:30 hr	<u>Valid</u> T+1 to T+2 hr T+2 to T+3 hr T+3 to T+4hr ... T+5 to T+6 hr	<u>To FSA</u> T+30 min T+1:30 hr T+2:30 hr ... T+5:30 hr	30 min after receipt of data M
10. Cat abort toxic hazard	Same as box 6; valid for 15 min intervals	<u>Developed</u> T-0 to T+10 min T+15 to T+30 min	<u>Valid</u> T+15 min to T+30 min T+30 min to T+45 min	<u>To FSA</u> T+15 min T+30 min	ASAP after Cat Abort M
11. Re-constructed T-0 weather profile for toxic analysis	Observed wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling, cloud sky coverage and turbulence measurements for 0-10,000 ft	T-0 to T+24 hr	T+24 hr	N/A	R

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ORBITAL SUBORBITAL PROGRAM TARGET LAUNCH VEHICLE

1.0. General. This annex specifies flight control support requirements for OSPTLV missions. The SMFCO may approve changes to this annex to accommodate operation-peculiar requirements.

2.0. Range Tracking Systems (RTS). Two adequate and independent instrumentation data sources from liftoff through flight control end of mission are MANDATORY.

2.1. Radar. Radars supporting a MANDATORY requirement must be capable of tracking in both skin and transponder modes. A radar slaving source is REQUIRED.

2.1.1. Local. One Vandenberg AFB radar with RF visibility to the launch site and ability to provide quality on-target track of either the booster or transponder no later than three (3) seconds prior to minimum time to endanger (MTE-3 sec) is MANDATORY for liftoff. Data from liftoff is REQUIRED. A second Vandenberg AFB radar is REQUIRED for liftoff.

2.1.2. Remote. One remote radar (downrange and/or crossrange from Vandenberg AFB) is MANDATORY for liftoff.

2.1.3. TNAR Filter. Not required.

2.2. Transponder. A trackable non-coherent C-band transponder on the launch vehicle is MANDATORY.

2.3. Telemetered Inertial Guidance (TMIG). One string of TMIG is MANDATORY and a second string is REQUIRED.

2.4. Global Positioning System (GPS). The use of a GPS translator or receiver shall be considered on a case-by-case basis until adequate experience has been gained to define these requirements. If flown, one string of GPS present position and IIP data is REQUIRED.

3.0. Telemetry. Receipt of telemetered data from the first FTS turn-on through flight control EOM is MANDATORY. One Vandenberg AFB TM site is MANDATORY and one TM site is MANDATORY. A telemetry slaving source is REQUIRED.

4.0. Command. The capture of the CRDs from turn on through flight control EOM is MANDATORY.

4.1. Command systems. A centrally controlled command processing system is MANDATORY. Configure CCS modes as follows:

CCS Mode	Configuration
Operational	Single Non-Redundant
Support	Standard
Failure	Dual

4.2. Command transmitters. Two Vandenberg AFB command transmitters with directional and omni-directional antennas and RF visibility to the launch site are MANDATORY. Two remote transmitters (downrange and/or crossrange from Vandenberg AFB) with directional antennas are MANDATORY. Power must be supplied to the MANDATORY command transmitters in such a way so that the loss of a single source of power will not disable both transmitters. Elevation of the directional antennas will not be less than three degrees unless directed by the MFCO. Carrier frequency is 416.5 MHz with +/- 30 kHz deviation per tone, Expanded Mode, Monitor 4. Initiate prime CCT switches from local to remote transmitter at T+55 sec. Initiate local omni to directional antenna switch at T+60 seconds.

4.3. Command slaving source. A real-time slaving source is MANDATORY for the directional antenna at each command transmitter site prime for supporting a MANDATORY command transmitter requirement.

4.4. Command failover. Automatic failover capability connecting all supporting command transmitters is MANDATORY.

4.5. Flight termination system (FTS). A redundant launch vehicle FTS is MANDATORY.

5.0. Displays. The continuous real-time display of launch vehicle performance and system status that affects flight safety is MANDATORY.

5.1. Tracking Display. Two complete Range Safety Display Systems (RSDS) are MANDATORY. Each string will consist of one MANDATORY and one REQUIRED display for the MFCO and one MANDATORY and one REQUIRED display for the RTDC. Display markers for support aircraft, seacraft, oil platforms and unsheltered launch area personnel are REQUIRED. A mission continuation display is REQUIRED.

5.2. MFCO Stripchart Display. Two stripchart recorders are REQUIRED. MFCC stripchart recorder console lights are REQUIRED. Configure the red and green lights above each MFCC stripchart recorder such that the green lights are illuminated when the telemetry bit stream is in sync and the red lights are illuminated when the bit stream is out of sync. MFCC stripchart recorders should be configured for best source display. Configure each stripchart recorder channel for full-scale data display.

5.2.1. Chamber Pressure. Booster chamber pressure telemetry for each engine is REQUIRED. Chamber pressure channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.2. Steering. Vehicle steering (yaw, pitch, roll) is REQUIRED. Steering channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.3. Automatic Gain Control (AGC). Command Receiver Decoder (CRD) AGC levels are REQUIRED. AGC assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

Table 5.1. MFCC Stripchart Recorder Channel Assignments.

Recorder #1

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/1	Yaw Rate	R
2/2	Pitch Rate	R
3/3	Roll Rate	R
4/4	Stage 1 Chamber Pressure	R
5/5	Stage 2 Chamber Pressure	R
6/6	Stage 3 Chamber Pressure	R
7/7	AGC Command Receiver 1	R
8/8	AGC Command Receiver 2	R
EVENT/9	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

Recorder #2

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/10	Yaw Rate	R
2/11	Pitch Rate	R
3/12	Roll Rate	R
4/13	Stage 1 Chamber Pressure	R
5/14	Stage 2 Chamber Pressure	R
6/15	Stage 3 Chamber Pressure	R
7/16	AGC Command Receiver 1	R
8/17	AGC Command Receiver 2	R
EVENT/18	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

5.3. FSPO Display. A real-time Range Safety telemetry display for the FSPO, capable of providing data until flight control EOM, is MANDATORY. FSPO display requirements are specified in Table 5.2, FSPO Display Locations & Requirements. RSTS FSPO console data display requirements are specified in Tables 3.3 through 3.6 at the end of this annex. A redundant RSTS console is DESIRED.

Table 5.2. FSPO Display Locations & Requirements.

Blockhouse		RSTS Display		RSTS Stripchart		QLDA-7 W/S	
T-0	Flight	T-0	Flight	T-0	Flight	T-0	Flight
M	R	R	R	R	M	D	D

5.4. Command Status Display. A MFCO status panel is MANDATORY for each active centrally controlled command processing system.

5.5. Attitude Display. Not required.

5.6. Mission Discrete Indicators (MDIs). MDIs are REQUIRED. MDI assignments are specified in Table 5.3, Mission Discrete Indicator Assignments.

Table 5.3. Mission Discrete Indicator Assignments.

<u>Parameter</u>	<u>Display</u>	<u>Display Color</u>	<u>Requirement</u>
TM Synchronization	SYNC	Red	R
Receiver 1 Armed	1ARM	Red	R
Receiver 1 Fired	1DST	Red	R
Thrust Termination	TT	Green	R
Stage 3/Payload Separation	3SEP	Green	R
Tone 4 Monitor, Receiver 1	TONE1	Red	R
Tone 4 Monitor, Receiver 2	TONE2	Red	R

6.0. Communications.

6.1. Voice Communications. MFCO voice communications are restricted from monitor access by agencies outside 30 SW/SE without written permission.

6.1.1. MFCO Voice Circuits. The MANDATORY and REQUIRED voice networks (nets) and voice direct lines (VDL) listed in Table 6.1, MFCO Voice Circuit Requirements, describe the voice circuit requirements at the MFCO-1 and MFCO-2 consoles. Access by all positions on the MFCO Safety Net is MANDATORY and each position will have talk and continuous monitor capability. RTS Range Safety Officer is added to the REQUIRED Range Safety Net. Table 6.2, RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements, describes the voice circuit requirements at the RSTS-1 and RSTS-2 consoles.

Table 6.1. MFCO Voice Circuit Requirements

Comm Circuit	Requirement	Comm Circuit	Requirement
MFCO Safety Net	M	RSTS FSPO*	R
Countdown Net	M	OSM*	R

CCT-1 Net	M	LST*	R
Safety Engineering Net	R	Program*	R
Range Safety Net	R	Back Az*	R
CCT-2 Net	R	ROC	R
Emergency Net	R	RCO	R
SCMDR Conf Net	R	ACO*	R
Safety Radio Net	R	LWO	R
Weather Conf Net	R	DCO	R
MFCO-1 (at MFCO-2)*	R	MCS/MC	R
MFCO-2 (at MFCO-1)*	R	SCMDR	R
CMD-1*	R	OD	R
CMD-2*	R	SE	R
RTDC-1*	R	Command Post	R
RTDC-2*	R	RM/ARM	R
TMO*	R	Class A Line	R
FSPO*	R		

* - Indicates positions with full MFCO Safety Net access.

Table 6.2. RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements

Comm Circuit	RSTS FSPO	RSTS QLDA-7
MFCO Safety Net	M	D (Monitor)
Countdown Net	M	D
Safety Engineering Net	R	-
CCT-1 Net	R	-
CCT-2 Net	R	-
Weather Conf Net	R	-
S/MFCO	R	-
FSPO	R	D
RSTS FSPO	-	D
RCO	R	-
SE	R	-
Class A Line	R	D

6.1.2. Provide one MANDATORY and two REQUIRED Class A telephone lines and one telephone for the Flight Safety Analyst workstation in the MFCC. A Class A telephone line between the MFCC Toxic Analyst workstation and DC-90 is MANDATORY. Access to a secure telephone in the MFCC is REQUIRED.

6.1.3. LST Communications. The MANDATORY and REQUIRED communication circuits listed in Table 6.3, LST Fallback Communication Access Requirements, will be provided at Fallback 22 for all launches utilizing LF-06 and at Fallback 21 for all launches utilizing LF-03. This

communication capability will be available from an outdoor location at Fallbacks 21 and 22. Additionally, this communication capability will be provided within the mobile command post vehicle (if available).

Table 6.3. LST Fallback Communication Access Requirements.

Comm Circuit	Requirement
MFCO Safety Net (T/M)	M
Countdown Net (M)	R
MFCO VDL	R
OSM VDL	R
ACO VDL	R
DCG VDL (Bldg 11165)	R
Class A Line	R

T = Talk capability

M = Monitor

6.1.4. ISB Communications. Range Safety Net and Countdown Net monitors are REQUIRED. A Class A administrative telephone is REQUIRED. Range countdown clock is REQUIRED. CCTV capability is REQUIRED.

6.2. Status/Alert (S&A) System. Status/Alert modules are REQUIRED at each MFCO console from the following positions: OSM, ACO, CMD-1, CMD-2, RTDC-1, RTDC-2, FSPO and RSTS FSPO.

6.3. Closed Circuit Television (CCTV). The following five (simultaneous) displays are REQUIRED on each MFCO console: Program TV, Back Az TV, Boat Plot, ADS and one long-range optic source. Available long-range optic sources may be split between each MFCO position. Best source video is REQUIRED at the ISB post.

6.4. Optics. One long-range optic source is REQUIRED. Two launch area video cameras, identified as Program and Back Az, are REQUIRED. Television van support locations for Program and Back Az are as follows:

Launch Site	Program Site	Back Az Site
LF-03	JB 85*	JB 86*
LF-06	JB 203	JB 78*

* - Indicates visibility to the launch pad

6.5. Missile Lift-off Signal. A positive lift-off indication is REQUIRED.

6.6. Command Communications. The data transmission link between each CCT and the central command system will consist of two MANDATORY and two REQUIRED complete and independent duplex command and status circuits as well as one MANDATORY and one REQUIRED complete and independent duplex pointing data circuits.

6.7. Range Communication.

6.7.1. All mission essential personnel located inside the Impact Limit Line (ILL) will have means to communicate with their control centers and the LST.

6.7.2. The ability to “breakaway” from a launch vehicle anomaly when directed for all supporting aircraft whose Test Support Point (TSP) lies within the ILL is MANDATORY. The ability to receive this communication is REQUIRED. If this communication capability is lost, “no-radio” (NORDO) procedures will be implemented, which shall include a return to base procedure to avoid closed airspace (impact boxes and up range hazard and caution areas).

6.8. Clocks. Visibility by all console positions within the Mission Flight Control Center (MFCC) to UTC, range countdown and pad clocks is REQUIRED.

7.0. Data Processing. The systems that process metric and telemetry data for output to MFCC displays are at the same level of decision authority as are required for the data to be displayed. Processing and transfer of weather data to MFCC systems are required at the levels of decision authority as specified in Appendix D, OSPTLV Weather System and Instrumentation Support Plan.

8.0. Meteorological. Receipt of weather data is MANDATORY and/or REQUIRED, as specified in Table 8.1, OSPTLV Atmospheric Data Requirements.

8.1. Local Atmospheric Data. See Table 8.1, OSPTLV Atmospheric Data Requirements.

8.2. Launch Commit Criteria. The Weather Aircraft is REQUIRED. Launch will not occur if weather conditions violate MANDATORY safety constraints for natural and triggered lightning, or triboelectrification, as described in Appendix C, Range Safety Weather Launch Commit Criteria.

8.3. Post Operation. See Table 8.1, OSPTLV Atmospheric Data Requirements.

9.0. Area Clearance. Clearance of all non-mission essential personnel from areas under 30 SW surveillance and control is MANDATORY.

9.1. On-shore Surface. Clearance of all non-mission essential personnel from land areas within the ILL, including the Union Pacific Railroad (UPRR) right-of-way, is MANDATORY. UPRR clearance is as follows (subject to day-of-launch real-time analysis):

Launch Site	Clearance Area
LF-03	3N-14N
LF-06	None*

* - UPRR Trainmaster will support

9.2. Offshore Surface. Clearance of danger zones and hazard areas, including uprange impact areas, is MANDATORY.

9.3. Airspace. Clearance of non-mission essential aircraft from launch safety airspace is MANDATORY.

9.4. Surveillance. A surveillance helicopter is REQUIRED. The UPRR Trainmaster is REQUIRED. NAWC boat support is REQUIRED.

9.5. Recovery. Not required.

10.0. Data Requirements. All items are REQUIRED. See Table 10.1, Data Requirements.

Table 10.1. Data Requirements.

Data Item	Title	Data	Deliver
380.00	Post Launch Analysis Of Radar Systems, Letter Report	PLARS Report	17 WD
401.00	Video Cassette Recording	Format: SVHS (DVD is DESIRED) Time: T-90 seconds - LOV Video: Composite of Program, Back Az, LA-24, Santa Ynez, Vehicle on-board Audio: Ch 1 MFCO Safety Net; Ch 2 IRIG-B	3 WD
416.00	Single Channel Voice Recording	Voice-operated MFCO communications (Compact Disc)	On Request
927.00	Events Display Recording – Range Safety	MFCC MFCO Stripchart Recorders 1 & 2	30 Minutes
928.00	Events Display Recording – Flight Safety	MFCC RSTS Stripchart Recorders 1 & 2	30 Minutes

TABLE 3.2. OSPTLV RSTS FSPO STRIPCHART SETUP SHEET

FSPO-1FSPO-2

Channel No.	Description	Type	Range Low	Range High	Channel No.	Description	Type	Range Low	Range High
1 SYNC	FRAME SYNC	S	0 OFF	1 ON	1 SYNC	FRAME SYNC	S	0 OFF	1 ON
2 FTS001	AGC A	A	0 Volts	5 Volts	2 FTS001	AGC A	A	0 Volts	5 Volts
3 FTS022.005	CK 4 A	D	0	1	3 FTS022.005	CK 4 A	D	0	1
4 FTS022.007	ARM A	D	0	1	4 FTS022.007	ARM A	D	0	1
5 FTS017	DESTRUCT A	A	0 Volts	20 Volts	5 FTS017	DESTRUCT A	A	0 Volts	20 Volts
6 FTS 005	CRD A BATT	A	0 Volts	38.33 Volts	6 FTS005	CRD A BATT	A	0 Volts	38.33 Volts
7 FTS002	AGC B	A	0 Volts	5 Volts	7 FTS002	AGC B	A	0 Volts	5 Volts
8 FTS022.004	CK 4 B	D	0	1	8 FTS022.004	CK 4 B	D	0	1
9 FTS022.006	ARM B	D	0	1	9 FTS022.006	ARM B	D	0	1
10 FTS019	DESTRUCT B	A	0 Volts	20 Volts	10 FTS019	DESTRUCT B	A	0 Volts	20 Volts
11 FTS006	CRD B BATT	A	0 Volts	38.33 Volts	11 FTS006	CRD B BATT	A	0 Volts	38.33 Volts
12					12				
13					13				
14					14				
15					15				
16					16				
17					17				
18					18				
19					19				
20					20				
21					21				
22					22				
23					23				
24					24				
25					25				
26					26				
27					27				
28					28				
29					29				
30					30				
31					31				
32	TIMING	IRIG B			32	TIMING	IRIG B		

TABLE 3.3. OSPTLV RSTS DISPLAY EXAMPLE

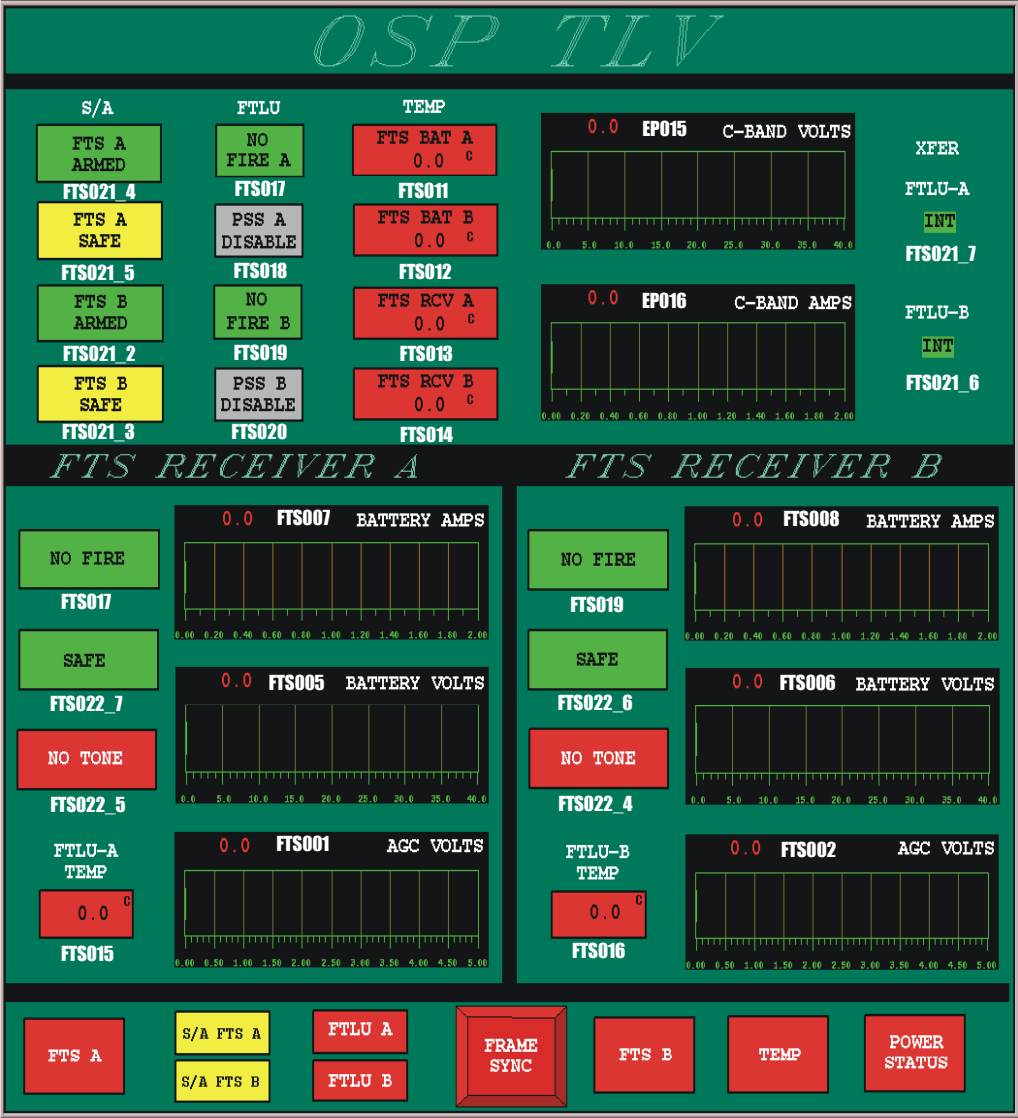


TABLE 3.4. OSPTLV RSTS LIMITS

Measurement ID	MEASUREMENT DESCRIPTION	Data Type	Resolution	Units	Display Range		Limit Checking				Latching State
							YELLOW		RED		
FTS001	C/D RCVR A AGC	FLOAT	3.1	VOLTS	0.0	5.0	< 2.5		< 2.0		
FTS002	C/D RCVR B AGC	FLOAT	3.1	VOLTS	0.0	5.0	< 2.5		< 2.0		
FTS005	FTLU-A BUS VOLTS	FLOAT	3.1	VOLTS	0.0	38.33	< 29.0	> 33.0	< 28.0	>34.0	
FTS006	FTLU-B BUS VOLTS	FLOAT	3.1	VOLTS	0.0	38.3	< 29.0	> 33.0	< 28.0	> 34.0	
FTS007	FTLU-A BUS AMPS	FLOAT	3.1	AMPS	0.0	19.3			< 0.25	> 1.0	
FTS008	FTLU-B BUS AMPS	FLOAT	3.1	AMPS	0.0	19.3			< 0.25	> 1.0	
FTS011	FTLU-A BATT TEMP	FLOAT	3.1	Deg C	-128.0	127.0			< 18.0	> 32.0	
FTS012	FTLU-B BAT TEMP	FLOAT	3.1	Deg C	-128.0	127.0			< 18.0	> 32.0	
FTS013	C/D RCVR A TEMP	FLOAT	3.1	Deg C	-128.0	127.0			< 18.0	> 42.0	
FTS014	C/D RCVR B TEMP	FLOAT	3.1	Deg C	-128.0	127.0			< 18.0	> 42.0	
FTS015	FTLU-A TEMP	FLOAT	3.1	Deg C	-128.0	127.0			< 18.0	> 32.0	
FTS016	FTLU-B TEMP	FLOAT	3.1	Deg C	-128.0	127.0			< 18.0	> 32.0	
FTS017 ¹	FTLU-A FIRE MON	FLOAT	3.1	VOLTS	0.0	20.0				> 1.0	
FTS018 ²	FTLU-A PSS ENABLE	FLOAT	3.1	VOLTS	0.0	20.0			< 1.0	> 3.0	
FTS019	FTLU-B FIRE MON	FLOAT	3.1	VOLTS	0.0	20.0				> 1.0	
FTS020	FTLU-B PSS ENABLE	FLOAT	3.1	VOLTS	0.0	20.0			< 1.0	> 3.0	
EP015	C-BAND XPONDER	FLOAT	3.1	VOLTS	-39.05	39.05			< 28.0	> 33.0	
EP016	C-BAND XPONDER	FLOAT	3.1	AMPS	-5.00	5.00			< 0.2	> 1.6	

NOTES:

¹FTS017 AND FTS019 NO FIRE (GREEN) <= 1.0 FIRE (RED) > 3.0²FTS018 AND FTS020 DISABLE (GRAY) <= 3.0 ENABLE > 3.0 (GREEN).

TABLE 3.5. OSPTLV RSTS LATCHING

Measure- ment ID	MEASUREMENT DESCRIPTION	Data Type	Display Color		Display Text		Latching State
			OFF	ON	OFF	ON	
FTS021_2	FTS B S&A ARM	STATE	GREEN	GRAY	ARM	SAFE	
FTS021_3	FTS B S&A SAFE	STATE	YELLOW	GRAY	SAFE	ARM	
FTS021_4	FTS A S&A ARM	STATE	GREEN	GRAY	ARM	SAFE	
FTS021_5	FTS A S&A SAFE	STATE	YELLOW	GRAY	SAFE	ARM	
FTS021_6	FTS B BATT PTS	STATE	GREEN	RED	INTERNAL	EXTERNAL	
FTS021_7	FTS A BATT PTS	STATE	GREEN	RED	INTERNAL	EXTERNAL	
FTS022_4	C/D RCVR B CHK CHN	STATE	GRAY	GREEN	NO TONE	TONE	
FTS022_5	C/D RCVR A CHK CHN	STATE	GRAY	GREEN	NO TONE	TONE	
FTS022_6	C/D RCVR B ARM	STATE	GREEN	RED	SAFE	ARM	
FTS022_7	C/D RCVR A ARM	STATE	GREEN	RED	SAFE	ARM	
FTS017	FTLU-A FIRE MON	FLOAT	GRAY	RED	< 1.0	> 3.0	
FTS018	FTLU-A PSS ENABLE	FLOAT	GRAY	GREEN	< 3.0	>3.0	
FTS019	FTLU-B FIRE MON	FLOAT	GRAY	RED	< 1.0	> 3.0	
FTS020	FTLU-B PSS ENABLE	FLOAT	GRAY	GREEN	< 3.0	>3.0	

TABLE 3.6. OSPTLV RSTS GREEN BOARD MEASUREMENT LIST

FTS A	SAFE/ARM FTS	FTLU A/B	FRAME SYNC	FTS B	TEMPERATURE	POWER STATUS
FTS017	S/A FTS A	FTLU-A		FTS019	FTS011	FTS021_6
FTS022_7	FTS021_4	FTS017		FTS022_6	FTS012	FTS021_7
FTS022_5	FTS021_5	FTS018		FTS022_4	FT013	
FTS015				FTS016	FTS014	
FTS007				FTS008		
FTS005	S/A FTS B	FTLU-A		FTS006		
FTS001	FTS021_2	FTS019		FTS002		
	FTS021_3	FTS020				

NOTE: Measurements are logically “anded.” All measurements must be within tolerance or in a state that signifies a green condition.

TABLE 8.1. OSPTLV ATMOSPHERIC DATA REQUIREMENTS

Assessment	Atmospheric Parameters	Development Time by 30 WS		Data Sent to FSA	FSA Analysis Complete	Requirement
1. L-1 day debris risk	T-0 forecast of wind speed and direction, 0-60,000 ft	N/A		N/A	N/A	NR
2. L-1 day toxic risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-10,000 ft	N/A		N/A	N/A	NR
3. L-1 day overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A		N/A	N/A	NR
4. RSDS display	Observed wind speed and direction, 0-60,000 ft (met input sent to ROMSSC)	T-8 to T-4:45 hr		Update complete by T-3 hr		R
5. Pre-launch debris risk	Observed wind speed and direction, 0-60,000 ft	T-8 to T-5 hr (NLT T-6 hr) T-4 to T-1:30 hr (NLT T-2:30 hr)		T-4:30 hr T-1 hr	T-3 hr T-30 min	M M
6. Pre-launch toxic risk	T-0 forecast of wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling and cloud sky coverage for 0-10,000 ft	T-4:30 to T-2:30 hr T-3:30 to T-1:30 hr (all valid T-0 to T+1 hr)		T-2:30 hr T-1:30 hr	T-1:45 hr T-:45 min	R M
7. Pre-launch overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A		N/A	N/A	NR
8. Liftoff toxic hazard	Same as box 6	<u>Developed</u> T-1:30 hr to T-10 min	<u>Valid</u> T-0 to T+10 min	<u>To FSA</u> T-10 min	T-2 mins	R
9. Launch delay toxic risk	Same as box 6; valid for 60 min intervals	<u>Developed</u> T-1:30 hr to T-0 T+30 min to T+1:30 hr T+1:00 to T+2:30 hr ... T+3:30 to T+4:30 hr	<u>Valid</u> T+1 to T+2 hr T+2 to T+3 hr T+3 to T+4hr ... T+5 to T+6 hr	<u>To FSA</u> T+30 min T+1:30 hr T+2:30 hr ... T+5:30 hr	30 min after receipt of data	M
10. Cat abort toxic hazard	Same as box 6; valid for 15 min intervals	<u>Developed</u> T-0 to T+10 min T+15 to T+30 min	<u>Valid</u> T+15 min to T+30 min T+30 min to T+45 min	<u>To FSA</u> T+15 min T+30 min	ASAP after Cat Abort	M
11. Re-constructed T-0 weather profile for toxic analysis	Observed wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling, cloud sky coverage and turbulence measurements for 0-10,000 ft	T-0 to T+24 hr		T+24 hr	N/A	R

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GROUND-BASED MIDCOURSE DEFENSE BOOSTER VERIFICATION

1.0. General. This annex specifies flight control support requirements for all Ground-based Midcourse Defense (GMD) Booster Verification tests.

2.0. Range Tracking Systems (RTS). Two adequate and independent instrumentation data sources from liftoff through flight control end of mission are MANDATORY.

2.1. Radar. Radars supporting a MANDATORY requirement must be capable of tracking in both skin and transponder modes. One radar providing skin track throughout powered flight is REQUIRED. A radar slaving source is REQUIRED.

2.1.1. Local. One Vandenberg AFB radar with RF visibility to the launch site and ability to provide quality on-target track of either the booster or transponder no later than three (3) seconds prior to minimum time to endanger (MTE-3 sec) is MANDATORY for liftoff. Data from liftoff is REQUIRED. A second Vandenberg AFB radar is REQUIRED for liftoff.

2.1.2. Remote. One remote radar (downrange and/or crossrange from Vandenberg AFB) is MANDATORY for liftoff.

2.1.3. TNAR Filter. Not required.

2.2. Transponder. A trackable non-coherent C-band transponder on the launch vehicle is MANDATORY.

2.3. Telemetered Inertial Guidance (TMIG). One string of TMIG is MANDATORY and a second string is REQUIRED.

2.4. Global Positioning System (GPS). Not applicable.

3.0. Telemetry. Receipt of telemetered data from the first FTS turn-on through flight control EOM is MANDATORY. One Vandenberg AFB TM site is MANDATORY and one TM site is MANDATORY. A telemetry slaving source is REQUIRED.

4.0. Command. The capture of the CRDs from the first turn on through flight control EOM is MANDATORY.

4.1. Command systems. A centrally controlled command processing system is MANDATORY. The same command system will be used for all supporting transmitter sites (CCS or CCPS). If used, configure CCS modes as follows:

CCS Mode	Configuration
Operational	Single Non-Redundant
Support	Standard
Failure	Dual

4.2. Command transmitters. Two Vandenberg AFB command transmitters with directional and omni-directional antennas and RF visibility to the launch site are MANDATORY. Two remote transmitters (downrange and/or crossrange from Vandenberg AFB) with directional antennas are MANDATORY. Power must be supplied to the MANDATORY command transmitters in such a way so that the loss of a single source of power will not disable both transmitters. Elevation of the directional antennas will not be less than three degrees unless directed by the MFCO. Carrier frequency is 416.5 MHz with +/- 30 kHz deviation per tone, Expanded Mode, Monitor 4. Initiate prime CCT switches from local to remote transmitter at T+55 seconds. Initiate local omni to directional antenna switch at T+60 seconds.

4.3. Command slaving source. A real-time slaving source is MANDATORY for the directional antenna at each command transmitter site prime for supporting a MANDATORY command transmitter requirement.

4.4. Command failover. Automatic failover capability connecting all supporting command transmitters is MANDATORY.

4.5. Flight termination system (FTS). A redundant launch vehicle FTS is MANDATORY.

5.0. Displays. The continuous real-time display of launch vehicle performance and system status that affects flight safety is MANDATORY.

5.1. Tracking Display. Two complete Range Safety Display Systems (RSDS) are MANDATORY. Each string will consist of one MANDATORY and one REQUIRED display for the MFCO and one MANDATORY and one REQUIRED display for the RTDC. Display markers for support aircraft, seacraft, oil platforms and unsheltered launch area personnel are REQUIRED. A mission continuation display is REQUIRED.

5.2. MFCO Stripchart Display. Two stripchart recorders are REQUIRED. MFCC stripchart recorder console lights are REQUIRED. Configure the red and green lights above each MFCC stripchart recorder such that the green lights are illuminated when the telemetry bit stream is in sync and the red lights are illuminated when the bit stream is out of sync. MFCC stripchart recorders should be configured for best source display. Configure each stripchart recorder channel for full-scale data display.

5.2.1. Chamber Pressure. Booster chamber pressure telemetry for each engine is REQUIRED. Chamber pressure channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.2. Steering. Vehicle steering (yaw, pitch, roll) is REQUIRED. Steering channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.3. Automatic Gain Control (AGC). Command Receiver Decoder (CRD) AGC levels are REQUIRED. AGC assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

Table 5.1. MFCC Stripchart Recorder Channel Assignments.

Recorder #1

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/1	Yaw Rate	R
2/2	Pitch Rate	R
3/3	Roll Rate	R
4/4	Stage 1 Chamber Pressure	R
5/5	Stage 2 Chamber Pressure	R
6/6	Stage 3 Chamber Pressure	R
7/7	AGC Command Receiver A	R
8/8	AGC Command Receiver B	R
EVENT/9	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

Recorder #2

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/10	Yaw Rate	R
2/11	Pitch Rate	R
3/12	Roll Rate	R
4/13	Stage 1 Chamber Pressure	R
5/14	Stage 2 Chamber Pressure	R
6/15	Stage 3 Chamber Pressure	R
7/16	AGC Command Receiver A	R
8/17	AGC Command Receiver B	R
EVENT/18	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

5.3. FSPO Display. A real-time Range Safety telemetry display for the FSPO, capable of providing data until flight control EOM, is MANDATORY. FSPO display requirements are specified in Table 5.2, FSPO Display Locations & Requirements. RSTS FSPO console data display requirements are specified in Tables 3.3 through 3.6 at the end of this annex and are TBD. A redundant RSTS console is DESIRED.

Table 5.2. FSPO Display Locations & Requirements.

Blockhouse		RSTS Display		RSTS Stripchart		QLDA-7 W/S	
T-0	Flight	T-0	Flight	T-0	Flight	T-0	Flight
M	R	LCB	LCB	R	M	D	D

5.4. Command Status Display. A MFCO status panel is MANDATORY for each active centrally controlled command processing system. Only displays for a single command system will be used (CCS or CCPS).

5.5. Attitude Display. Not required.

5.6. Mission Discrete Indicators (MDIs). MDIs are REQUIRED. MDI assignments are specified in Table 5.3, Mission Discrete Indicator Assignments.

Table 5.3. Mission Discrete Indicator Assignments.

<u>Parameter</u>	<u>Display</u>	<u>Display Color</u>	<u>Requirement</u>
TM Synchronization	SYNC	Red	R
Command Receiver A Armed	1ARM	Red	R
Command Receiver A Destruct	1DST	Red	R
Command Receiver B Armed	2ARM	Red	R
Command Receiver B Destruct	2DST	Red	R
Tone 4 Monitor, Receiver A	TONE1	Red	R
Tone 4 Monitor, Receiver B	TONE2	Red	R

6.0. Communications.

6.1. Voice Communications. MFCO voice communications are restricted from monitor access by agencies outside 30 SW/SE without written permission.

6.1.1. MFCO Voice Circuits. The MANDATORY and REQUIRED voice networks (nets) and voice direct lines (VDL) listed in Table 6.1, MFCO Voice Circuit Requirements, describe the voice circuit requirements at the MFCO-1 and MFCO-2 consoles. Access by all positions on the MFCO Safety Net is MANDATORY and each position will have talk and continuous monitor capability. Table 6.2, RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements, describes the voice circuit requirements at the RSTS-1 and RSTS-2 consoles.

Table 6.1. MFCO Voice Circuit Requirements

Comm Circuit	Requirement	Comm Circuit	Requirement
MFCO Safety Net	M	RSTS FSPO*	R
Countdown Net	M	OSM*	R

CCT-1 Net	M	LST*	R
Safety Engineering Net	R	Program*	R
Range Safety Net	R	Back Az*	R
CCT-2 Net	R	ROC	R
Emergency Net	R	RCO	R
SCMDR Conf Net	R	ACO*	R
Safety Radio Net	R	LWO	R
Weather Conf Net	R	DCO	R
MFCO-1 (at MFCO-2)*	R	MCS/MC	R
MFCO-2 (at MFCO-1)*	R	SCMDR	R
CMD-1*	R	OD	R
CMD-2*	R	SE	R
RTDC-1*	R	Command Post	R
RTDC-2*	R	GTD	R
TMO*	R	RC	R
FSPO*	R	Class A Line	R

* - Indicates positions with full MFCO Safety Net access.

Table 6.2. RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements

Comm Circuit	RSTS FSPO	RSTS QLDA-7
MFCO Safety Net	M	D (Monitor)
Countdown Net	M	D
Safety Engineering Net	R	-
CCT-1 Net	R	-
CCT-2 Net	R	-
Weather Conf Net	R	-
S/MFCO	R	-
FSPO	R	D
RSTS FSPO	-	D
RCO	R	-
SE	R	-
Class A Line	R	D

6.1.2. Provide one MANDATORY and two REQUIRED Class A telephone lines and one telephone for the Flight Safety Analyst workstation in the MFCC. A Class A telephone line between the MFCC Toxic Analyst workstation and DC-90 is MANDATORY. Access to a secure telephone in the MFCC is REQUIRED.

6.1.3. LST Communications. The MANDATORY and REQUIRED communication circuits listed in Table 6.3, LST Fallback Communication Access Requirements, will be provided at Fallback 21 for all launches utilizing LF-21. This communication capability will be available from an outdoor

location at Fallback 21. Additionally, this communication capability will be provided within the mobile command post vehicle (if available).

Table 6.3. LST Fallback Communication Access Requirements.

Comm Circuit	Requirement
MFCO Safety Net (T/M)	M
Countdown Net (M)	R
MFCO VDL	R
OSM VDL	R
ACO VDL	R
DCG VDL (Bldg 11165)	R
Class A Line	R

T = Talk capability

M = Monitor

6.1.4. ISB Communications. Range Safety Net and Countdown Net monitors are REQUIRED. A Class A administrative telephone is REQUIRED. Range countdown clock is REQUIRED. CCTV capability is REQUIRED.

6.2. Status/Alert (S&A) System. Status/Alert modules are REQUIRED at each MFCO console from the following positions: OSM, ACO, CMD-1, CMD-2, RTDC-1, RTDC-2, FSPO and RSTS FSPO.

6.3. Closed Circuit Television (CCTV). The following five (simultaneous) displays are REQUIRED on each MFCO console: Program TV, Back Az TV, Boat Plot, ADS and one long-range optic source. Available long-range optic sources may be split between each MFCO position. Best source video is REQUIRED at the ISB post.

6.4. Optics. One long-range optic source is REQUIRED. Two launch area video cameras, identified as Program and Back Az, are REQUIRED. Television van support locations for Program and Back Az are as follows:

Launch Site	Program Site	Back Az Site
LF-21	JB 13*	JB 85

* - Indicates visibility to the launch pad

6.5. Missile Lift-off Signal. A positive lift-off indication is REQUIRED.

6.6. Command Communications. The data transmission link between each CCT and the central command system will consist of two MANDATORY and two REQUIRED complete and

independent duplex command and status circuits as well as one MANDATORY and one REQUIRED complete and independent duplex pointing data circuits.

6.7. Range Communications.

6.7.1. All mission essential personnel located inside the Impact Limit Line (ILL) will have means to communicate with their control centers and the LST.

6.7.2. The ability to “breakaway” from a launch vehicle anomaly when directed for all supporting aircraft whose Test Support Point (TSP) lies within the ILL is MANDATORY. The ability to receive this communication is REQUIRED. If this communication capability is lost, “no-radio” (NORDO) procedures will be implemented, which shall include a return to base procedure to avoid closed airspace (impact boxes and up range hazard and caution areas).

6.8. Clocks. Visibility by all console positions within the Mission Flight Control Center (MFCC) to UTC, range countdown and pad clocks is REQUIRED.

7.0. Data Processing. The systems that process metric and telemetry data for output to MFCC displays are at the same level of decision authority as are required for the data to be displayed. Processing and transfer of weather data to MFCC systems are required at the levels of decision authority as specified in Appendix D, GMD BV Weather System and Instrumentation Support Plan.

8.0. Meteorological. Receipt of weather data is MANDATORY and/or REQUIRED, as specified in Table 8.1, GMD BV Atmospheric Data Requirements.

8.1. Local Atmospheric Data. See Table 8.1, GMD BV Atmospheric Data Requirements.

8.2. Launch Commit Criteria. The Weather Aircraft is REQUIRED. Launch will not occur if weather conditions violate MANDATORY safety constraints for natural and triggered lightning, or triboelectrification, as described in Appendix C, Range Safety Weather Launch Commit Criteria.

8.3. Post Operation. See Table 8.1, GMD BV Atmospheric Data Requirements.

9.0. Area Clearance. Clearance of all non-mission essential personnel from areas under 30 SW surveillance and control is MANDATORY.

9.1. On-shore Surface. Clearance of all non-mission essential personnel from land areas within the ILL, including the Union Pacific Railroad (UPRR) right-of-way, is MANDATORY. UPRR clearance is as follows (subject to day-of-launch real-time analysis):

Launch Site	Clearance Area
LF-21	3N-14N

9.2. Offshore Surface. Clearance of danger zones and hazard areas, including uprange impact areas, is MANDATORY.

9.3. Airspace. Clearance of non-mission essential aircraft from launch safety airspace is MANDATORY.

9.4. Surveillance. A surveillance helicopter is REQUIRED. The UPRR Trainmaster is REQUIRED. NAWC boat support is REQUIRED.

9.5. Recovery. Not required.

10.0. Data Requirements. All items are REQUIRED. See Table 10.1, Data Requirements.

Table 10.1. Data Requirements.

Data Item	Title	Data	Deliver
380.00	Post Launch Analysis Of Radar Systems, Letter Report	PLARS Report	17 WD
401.00	Video Cassette Recording	Format: SVHS (DVD is DESIRED) Time: T-90 seconds - LOV Video: Composite of Program, Back Az, LA-24, Santa Ynez, Vehicle on-board Audio: Ch 1 MFCO Safety Net; Ch 2 IRIG-B	3 WD
416.00	Single Channel Voice Recording	Voice-operated MFCO communications (Compact Disc)	On Request
927.00	Events Display Recording – Range Safety	MFCC MFCO Stripchart Recorders 1 & 2	30 Minutes
928.00	Events Display Recording – Flight Safety	MFCC RSTS Stripchart Recorders 1 & 2	30 Minutes

TABLE 3.2. GMD BV RSTS FSPO STRIPCHART SETUP SHEET

FSPO-1FSPO-2

Channel No.	Description	Type	Range Low	Range High	Channel No.	Description	Type	Range Low	Range High
1					1				
2					2				
3					3				
4					4				
5					5				
6					6				
7					7				
8					8				
9					9				
10					10				
11					11				
12					12				
13					13				
14					14				
15					15				
16					16				
17					17				
18					18				
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21					21				
22					22				
23					23				
24					24				
25					25				
26					26				
27					27				
28					28				
29					29				
30					30				
31					31				
32	TIMING	IRIG B			32	TIMING	IRIG B		

TABLE 3.3. GMD BV RSTS DISPLAY EXAMPLE

TBD

TABLE 3.4. GMD BV RSTS LIMITS

[illegible]

TABLE 3.5. GMD BV RSTS LATCHING[illegible]

TABLE 3.6. GMD BV RSTS GREEN BOARD MEASUREMENT LIST

[illegible]

TABLE 8.1. GMD BV ATMOSPHERIC DATA REQUIREMENTS

Assessment	Atmospheric Parameters	Development Time by 30 WS	Data Sent to FSA	FSA Analysis Complete	Requirement
1. L-1 day debris risk	T-0 forecast of wind speed and direction, 0-60,000 ft	N/A	N/A	N/A	NR
2. L-1 day toxic risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-10,000 ft	N/A	N/A	N/A	NR
3. L-1 day overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A	N/A	N/A	NR
4. RSDS display	Observed wind speed and direction, 0-60,000 ft (met input sent to ROMSSC)	T-8 to T-4:45 hr	Update complete by T-3 hr		R
5. Pre-launch debris risk	Observed wind speed and direction, 0-60,000 ft	T-8 to T-5 hr (NLT T-6 hr) T-4 to T-1:30 hr (NLT T-2:30 hr)	T-4:30 hr T-1 hr	T-3 hr T-30 min	M M
6. Pre-launch toxic risk	T-0 forecast of wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling and cloud sky coverage for 0-10,000 ft	T-4:30 to T-2:30 hr T-3:30 to T-1:30 hr (all valid T-0 to T+1 hr)	T-2:30 hr T-1:30 hr	T-1:45 hr T-:45 min	R M
7. Pre-launch overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A	N/A	N/A	NR
8. Liftoff toxic hazard	Same as box 6	<u>Developed</u> T-1:30 hr to T-10 min	<u>Valid</u> T-0 to T+10 min	<u>To FSA</u> T-10 min	T-2 mins R
9. Launch delay toxic risk	Same as box 6; valid for 60 min intervals	<u>Developed</u> T-1:30 hr to T-0 T+30 min to T+1:30 hr T+1:00 to T+2:30 hr ... T+3:30 to T+4:30 hr	<u>Valid</u> T+1 to T+2 hr T+2 to T+3 hr T+3 to T+4hr ... T+5 to T+6 hr	<u>To FSA</u> T+30 min T+1:30 hr T+2:30 hr ... T+5:30 hr	30 min after receipt of data M
10. Cat abort toxic hazard	Same as box 6; valid for 15 min intervals	<u>Developed</u> T-0 to T+10 min T+15 to T+30 min	<u>Valid</u> T+15 min to T+30 min T+30 min to T+45 min	<u>To FSA</u> T+15 min T+30 min	ASAP after Cat Abort M
11. Re-constructed T-0 weather profile for toxic analysis	Observed wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling, cloud sky coverage and turbulence measurements for 0-10,000 ft	T-0 to T+24 hr	T+24 hr	N/A	R

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ATLAS IIAS

1.0. General. This annex specifies flight control support requirements for Atlas IIAS missions. The SMFCO may approve changes to this annex to accommodate operation-peculiar requirements.

2.0. Range Tracking Systems (RTS). Two adequate and independent instrumentation data sources from liftoff through flight control end of mission are MANDATORY.

2.1. Radar. Radars supporting a MANDATORY requirement must be capable of tracking in both skin and transponder modes. A radar slaving source is REQUIRED.

2.1.1. Local. One Vandenberg AFB radar with RF visibility to the launch site and ability to provide quality on-target track of either the booster or transponder no later than three (3) seconds prior to minimum time to endanger (MTE-3 sec) is MANDATORY for liftoff. Data from liftoff is REQUIRED. A second Vandenberg AFB radar is REQUIRED for liftoff.

2.1.2. Remote. One remote radar (downrange and/or crossrange from Vandenberg AFB) is MANDATORY for liftoff.

2.1.3. TNAR Filter. Not required.

2.2. Transponder. A trackable non-coherent C-band transponder on the launch vehicle is MANDATORY.

2.3. Telemetered Inertial Guidance (TMIG). One string of TMIG is MANDATORY and a second string is REQUIRED.

2.4. Global Positioning System (GPS). The use of a GPS translator or receiver shall be considered on a case-by-case basis until adequate experience has been gained to define these requirements. If flown, one string of GPS present position and IIP data is REQUIRED.

3.0. Telemetry. Receipt of telemetered data from the first FTS turn-on through flight control EOM is MANDATORY. One Vandenberg AFB TM site is MANDATORY and one TM site is MANDATORY. A telemetry slaving source is REQUIRED.

4.0. Command. The capture of the CRDs from turn on through flight control EOM is MANDATORY.

4.1. Command systems. A centrally controlled command processing system is MANDATORY. Configure CCS modes as follows:

CCS Mode	Configuration
Operational	Single Non-Redundant
Support	Secure
Failure	Dual

4.2. Command transmitters. Two Vandenberg AFB command transmitters with directional and omni-directional antennas and RF visibility to the launch site are MANDATORY. The primary transmitter system must have line-of-site to the pad. Two remote transmitters (downrange and/or crossrange from Vandenberg AFB) with directional antennas are MANDATORY. Power must be supplied to the MANDATORY command transmitters in such a way so that the loss of a single source of power will not disable both transmitters. Command transmitter site secure code capability is REQUIRED. Elevation of the directional antennas will not be less than three degrees unless directed by the MFCO. Carrier frequency is 416.5 MHz with +/- 30 kHz deviation per tone, Expanded Mode, Monitor 7. Initiate prime CCT switches from local to remote transmitter at T+70 seconds. Initiate local omni to directional antenna switch at T+75 seconds.

4.3. Command slaving source. A real-time slaving source is MANDATORY for the directional antenna at each command transmitter site prime for supporting a MANDATORY command transmitter requirement.

4.4. Command failover. Automatic failover capability connecting all supporting command transmitters is MANDATORY.

4.5. Flight termination system (FTS). A redundant launch vehicle FTS is MANDATORY.

5.0. Displays. The continuous real-time display of launch vehicle performance and system status that affects flight safety is MANDATORY.

5.1. Tracking Display. Two complete Range Safety Display Systems (RSDS) are MANDATORY. Each string will consist of one MANDATORY and one REQUIRED display for the MFCO and one MANDATORY and one REQUIRED display for the RTDC. Display markers for support aircraft, seacraft, oil platforms and unsheltered launch area personnel are REQUIRED. A mission continuation display is REQUIRED.

5.2. MFCO Stripchart Display. Two stripchart recorders are REQUIRED. MFCC stripchart recorder console lights are REQUIRED. Configure the red and green lights above each MFCC stripchart recorder such that the green lights are illuminated when the telemetry bit stream is in sync and the red lights are illuminated when the bit stream is out of sync. MFCC stripchart recorders should be configured for best source display. Configure each stripchart recorder channel for full-scale data display.

5.2.1. Chamber Pressure. Booster chamber pressure telemetry for each engine is REQUIRED. Chamber pressure channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.2. Steering. Vehicle steering (yaw, pitch, roll) is REQUIRED. Steering channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.3. Automatic Gain Control (AGC). Command Receiver Decoder (CRD) AGC levels for Atlas and Centaur are REQUIRED. AGC assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

Table 5.1. MFCC Stripchart Recorder Channel Assignments.

Recorder #1

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/1	Booster Engine 1 Chamber Pressure	R
2/2	Booster Engine 2 Chamber Pressure	R
3/3	Sustainer Engine Chamber Pressure	R
4/4	SRB Chamber Pressure Q1	R
5/5	SRB Chamber Pressure Q3	R
6/6	(OPEN)	-
7/7	SRB Chamber Pressure Q2	R
8/8	SRB Chamber Pressure Q4	R
9/9	Atlas FTS Signal Strength Rcvr 1	R
10/10	Atlas FTS Signal Strength Rcvr 2	R
11/11	Centaur FTS Signal Strength Rcvr 1	R
12/12	Centaur FTS Signal Strength Rcvr 2	R
EVENT/	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

Recorder #2

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/13	Yaw Rate (Atlas)	R
2/14	Pitch Rate (Atlas)	R
3/15	Roll Rate	R
4/16	Yaw Rate (Centaur)	R
5/17	Pitch Rate (Centaur)	R
6/18	(OPEN)	-
7/19	Centaur Engine 1 Chamber Pressure	R
8/20	Centaur Engine 2 Chamber Pressure	R
9/21	Atlas FTS Signal Strength Rcvr 1	R
10/22	Atlas FTS Signal Strength Rcvr 2	R
11/23	Centaur FTS Signal Strength Rcvr 1	R
12/24	Centaur FTS Signal Strength Rcvr 2	R
EVENT/	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

5.3. FSPO Display. A real-time Range Safety telemetry display for the FSPO, capable of providing data until flight control EOM, is MANDATORY. FSPO display requirements are specified in Table 5.2, FSPO Display Locations & Requirements. RSTS FSPO console data display requirements are specified in Tables 3.3 through 3.6 at the end of this annex. A redundant RSTS console is DESIRED.

Table 5.2. FSPO Display Locations & Requirements.

Blockhouse		RSTS Display		RSTS Stripchart		QLDA-7 W/S	
T-0	Flight	T-0	Flight	T-0	Flight	T-0	Flight
M	R	R	R	R	M	D	D

5.4. Command Status Display. A MFCO status panel is MANDATORY for each active centrally controlled command processing system.

5.5. Attitude Display. Not required.

5.6. Mission Discrete Indicators (MDIs). MDIs are REQUIRED. MDI assignments are specified in Table 5.3, Mission Discrete Indicator Assignments.

Table 5.3. Mission Discrete Indicator Assignments.

<u>Parameter</u>	<u>Display</u>	<u>Display Color</u>	<u>Requirement</u>
TM Synchronization	SYNC	Red	R
Guidance Error	GERR	Red	R
Go Inertial	GOIN	Green	R
Atlas Pilot Tone Monitor, Receiver 1A	ATONE1	Red	R
Atlas Pilot Tone Monitor, Receiver 2A	ATONE2	Red	R
Centaur Pilot Tone Monitor, Receiver 1C	CTONE1	Red	R
Centaur Pilot Tone Monitor, Receiver 2C	CTONE2	Red	R

6.0. Communications.

6.1. Voice Communications. MFCO voice communications are restricted from monitor access by agencies outside 30 SW/SE without written permission.

6.1.1. MFCO Voice Circuits. The MANDATORY and REQUIRED voice networks (nets) and voice direct lines (VDL) listed in Table 6.1, MFCO Voice Circuit Requirements, describe the voice circuit requirements at the MFCO-1 and MFCO-2 consoles. Access by all positions on the MFCO Safety Net is MANDATORY and each position will have talk and continuous monitor capability. Table 6.2, RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements, describes the voice circuit requirements at the RSTS-1 and RSTS-2 consoles.

Table 6.1. MFCO Voice Circuit Requirements

Comm Circuit	Requirement	Comm Circuit	Requirement
MFCO Safety Net	M	FSPO*	R
Countdown Net	M	RSTS FSPO*	R
CCT-1 Net	M	OSM*	R
Safety Engineering Net	R	LST*	R
Range Safety Net	R	Program*	R
CCT-2 Net	R	Back Az*	R
Emergency Net	R	ROC	R
SCMDR Conf Net	R	RCO	R
Safety Radio Net	R	ACO*	R
Weather Conf Net	R	LWO	R
AF Crew	R	DCO	R
PRN	R	MCS/MC	R
Range	R	SCMDR	R
MFCO-1 (at MFCO-2)*	R	OD	R
MFCO-2 (at MFCO-1)*	R	SE	R
CMD-1*	R	Command Post	R
CMD-2*	R	FTSO	R
RTDC-1*	R	AFLD/LMLD	R
RTDC-2*	R	AFLC	R
TMO*	R	Class A Line	R

* - Indicates positions with full MFCO Safety Net access.

Table 6.2. RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements

Comm Circuit	RSTS FSPO	RSTS QLDA-7
MFCO Safety Net	M	D (Monitor)
Countdown Net	M	D
Safety Engineering Net	R	-
CCT-1 Net	R	-
CCT-2 Net	R	-
Weather Conf Net	R	-
S/MFCO	R	-
FSPO	R	D
RSTS FSPO	-	D
RCO	R	-
SE	R	-
Class A Line	R	D

6.1.2. Provide one MANDATORY and two REQUIRED Class A telephone lines and one telephone for the Flight Safety Analyst workstation in the MFCC. A Class A telephone line between the MFCC Toxic Analyst workstation and DC-90 is MANDATORY. Access to a secure telephone in the MFCC is REQUIRED.

6.1.3. LST Communications. The MANDATORY and REQUIRED communication circuits listed in Table 6.3, LST Fallback Communication Access Requirements, will be provided at Fallback 9 for all launches utilizing SLC-3E. This communication capability will be available from an outdoor location at Fallback 9. Additionally, this communication capability will be provided within the support facility.

Table 6.3. LST Fallback Communication Access Requirements.

Comm Circuit	Requirement
MFCO Safety Net (T/M)	M
Countdown Net (M)	R
MFCO VDL	R
OSM VDL	R
ACO VDL	R
DCG VDL (Bldg 11165)	R
Class A Line	R

T = Talk capability

M = Monitor

6.1.4. ISB Communications. Range Safety Net and Countdown Net monitors are REQUIRED. A Class A administrative telephone is REQUIRED. Range countdown clock is REQUIRED. CCTV capability is REQUIRED.

6.2. Status/Alert (S&A) System. Status/Alert modules are REQUIRED at each MFCO console from the following positions: OSM, ACO, CMD-1, CMD-2, RTDC-1, RTDC-2, FSPO and RSTS FSPO.

6.3. Closed Circuit Television (CCTV). The following five (simultaneous) displays are REQUIRED on each MFCO console: Program TV, Back Az TV, Boat Plot, ADS and one long-range optic source. Available long-range optic sources may be split between each MFCO position. Best source video is REQUIRED at the ISB post.

6.4. Optics. One long-range optic source is REQUIRED. Two launch area video cameras, identified as Program and Back Az, are REQUIRED. Television van support locations for Program and Back Az are as follows:

Launch Site	Program Site	Back Az Site
SLC-3E	JB 539**	JB 502*

- * - Indicates visibility to the launch pad
- ** - Upper portion of launch vehicle is visible

6.5. Missile Lift-off Signal. A positive lift-off indication is REQUIRED.

6.6. Command Communications. The data transmission link between each CCT and the central command system will consist of two MANDATORY and two REQUIRED complete and independent duplex command and status circuits as well as one MANDATORY and one REQUIRED complete and independent duplex pointing data circuits.

6.7. Range Communication.

6.7.1. All mission essential personnel located inside the Impact Limit Line (ILL) will have means to communicate with their control centers and the LST.

6.7.2. The ability to “breakaway” from a launch vehicle anomaly when directed for all supporting aircraft whose Test Support Point (TSP) lies within the ILL is MANDATORY. The ability to receive this communication is REQUIRED. If this communication capability is lost, "no-radio" (NORDO) procedures will be implemented, which shall include a return to base procedure to avoid closed airspace (impact boxes and up range hazard and caution areas).

6.8. Clocks. Visibility by all console positions within the Mission Flight Control Center (MFCC) to UTC, range countdown and pad clocks is REQUIRED.

7.0. Data Processing. The systems that process metric and telemetry data for output to MFCC displays are at the same level of decision authority as are required for the data to be displayed. Processing and transfer of weather data to MFCC systems are required at the levels of decision authority as specified in Appendix D, Atlas IIAS Weather System and Instrumentation Support Plan.

8.0. Meteorological. Receipt of weather data is MANDATORY and/or REQUIRED, as specified in Table 8.1, Atlas IIAS Atmospheric Data Requirements.

8.1. Local Atmospheric Data. See Table 8.1, Atlas IIAS Atmospheric Data Requirements.

8.2. Launch Commit Criteria. The Weather Aircraft is REQUIRED. Launch will not occur if weather conditions violate MANDATORY safety constraints for natural and triggered lightning, or triboelectrification, as described in Appendix C, Range Safety Weather Launch Commit Criteria.

8.3. Post Operation. See Table 8.1, Atlas IIAS Atmospheric Data Requirements.

9.0. Area Clearance. Clearance of all non-mission essential personnel from areas under 30 SW surveillance and control is MANDATORY.

9.1. On-shore Surface. Clearance of all non-mission essential personnel from land areas within the ILL, including the Union Pacific Railroad (UPRR) right-of-way, is MANDATORY. UPRR clearance is as follows (subject to day-of-launch real-time analysis):

Launch Site	Clearance Area
SLC-3E	Surf-32S

9.2. Offshore Surface. Clearance of danger zones and hazard areas, including uprange impact areas, is MANDATORY.

9.3. Airspace. Clearance of non-mission essential aircraft from launch safety airspace is MANDATORY.

9.4. Surveillance. A surveillance helicopter is REQUIRED. The UPRR Trainmaster is REQUIRED. NAWC boat support is REQUIRED.

9.5. Recovery. Location (longitude and latitude), report of physical condition, and recovery of nozzle closures (when safe and environmentally sound) is REQUIRED.

10.0. Data Requirements. All items are REQUIRED. See Table 10.1, Data Requirements.

Table 10.1. Data Requirements.

Data Item	Title	Data	Deliver
380.00	Post Launch Analysis Of Radar Systems, Letter Report	PLARS Report	17 WD
401.00	Video Cassette Recording	Format: SVHS (DVD is DESIRED) Time: T-90 seconds - LOV Video: Composite of Program, Back Az, LA-24, Santa Ynez, Pad/MST, Vehicle on-board Audio: Ch 1 MFCO Safety Net; Ch 2 IRIG-B	3 WD
416.00	Single Channel Voice Recording	Voice-operated MFCO communications (Compact Disc)	On Request
927.00	Events Display Recording – Range Safety	MFCC MFCO Stripchart Recorders 1 & 2	30 Minutes
928.00	Events Display Recording – Flight Safety	MFCC RSTS Stripchart Recorders 1 & 2	30 Minutes

TABLE 3.2. ATLAS IIAS RSTS FSPO STRIPCHART SETUP SHEET

FSPO-1FSPO-2

Channel No.	Description	Type	Range Low	Range High	Channel No.	Description	Type	Range Low	Range High
1 SYNC	FRAME SYNC	S	0 OFF	1 ON	1 SYNC	FRAME SYNC	S	0 OFF	1 ON
2 ADT120V	AGC A	A	0 Volts	5 Volts	2 ADT120V	AGC A	A	0 Volts	5 Volts
3 ADT142X	CK 4 A	D	0	1	3 ADT142X	CK 4 A	D	0	1
4 ADT130X	ARM A	D	0	1	4 ADT130X	ARM A	D	0	1
5 ADT132X	DESTRUCT A	D	0	1	5 ADT132X	DESTRUCT A	D	0	1
6 ADT121V	AGC B	A	0 Volts	5 Volts	6 ADT121V	AGC B	A	0 Volts	5 Volts
7 ADT143X	CK 4 B	D	0	1	7 ADT143X	CK 4 B	D	0	1
8 ADT131X	ARM B	D	0	1	8 ADT131X	ARM B	D	0	1
9 ADT133X	DESTRUCT B	D	0	1	9 ADT133X	DESTRUCT B	D	0	1
10					10				
11 CDT170V	AGC A	A	0 Volts	5 Volts	11 CDT170V	AGC A	A	0 Volts	5 Volts
12 CDT192X	CK 4 A	D	0	1	12 CDT192X	CK 4 A	D	0	1
13 CDT180X	ARM A	D	0	1	13 CDT180X	ARM A	D	0	1
14 CDT182X	DESTRUCT A	D	0	1	14 CDT182X	DESTRUCT A	D	0	1
15 CDT171V	AGC B	A	0 Volts	5 Volts	15 CDT171V	AGC B	A	0 Volts	5 Volts
16 CDT193X	CK 4 B	D	0	1	16 CDT193X	CK 4 B	D	0	1
17 CDT181X	ARM B	D	0	1	17 CDT181X	ARM B	D	0	1
18 CDT183X	DESTRUCT B	D	0	1	18 CDT183X	DESTRUCT B	D	0	1
19					19				
20					20				
21					21				
22					22				
23					23				
24					24				
25					25				
26					26				
27					27				
28					28				
29					29				
30					30				
31					31				
32	TIMING	IRIG A			32	TIMING	IRIG A		

TABLE 3.3. ATLAS IIAS RSTS DISPLAY EXAMPLE



TABLE 3.3. ATLAS IIAS RSTS DISPLAY EXAMPLE – CONTINUED



TABLE 3.4. ATLAS IIAS RSTS LIMITS

MEASUREMENT ID	MEASUREMENT DESCRIPTION	Data Type	Reso- lution	Units	Display Range		Limit Checking				Latching State
							YELLOW		RED		
CE661C	BATT 1 AMPS	FLOAT	3.1	AMPS	-0.012	1.02					
CE663C	BATT 2 AMPS	FLOAT	3.1	AMPS	-0.012	1.02					
CET021V	FTS BAT NO. 1	FLOAT	3.1	VOLTS	0.0	40.0	< 28.0		< 22.0	> 33.0	
CET022V	FTS BAT NO. 2	FLOAT	3.1	VOLTS	0.0	40.0	< 28.0		< 22.0	> 33.0	
CDT170V	FTS RCVR 1 SIG STR	FLOAT	3.1	VOLTS	0.0	5.0			< 1.0		
CDT171V	FTS RCVR 2 SIG STR	FLOAT	3.1	VOLTS	0.0	5.0			< 1.0		
CE056T	FTS BAT 1 TEMP	FLOAT	3.1	DEG/F	-0.4	199.6	< 70.0	> 140.0	< 65.0	> 147.0	
CE057T	FTS BAT 2 TEMP	FLOAT	3.1	DEG/F	-0.4	199.6	< 70.0	> 140.0	< 65.0	> 147.0	
AE661C	BATT 1 AMPS	FLOAT	3.1	AMPS	-0.012	1.02					
AE663C	BATT 2 AMPS	FLOAT	3.1	AMPS	-0.012	1.02					
AET629V	FTS BAT NO. 1	FLOAT	3.1	VOLTS	0.0	40.0	< 28.0		< 22.0	> 33.0	
AET630V	FTS BAT NO. 1	FLOAT	3.1	VOLTS	0.0	40.0	< 28.0		< 22.0	> 33.0	
ADT120V	FTS RCVR 1 SIG STR	FLOAT	3.1	VOLTS	0.0	5.0			< 1.0		
ADT121V	FTS RCVR 2 SIG STR	FLOAT	3.1	VOLTS	0.0	5.0			< 1.0		
AE728T	FTS BAT 1 TEMP	FLOAT	3.1	DEG/F	-0.4	199.6	< 70.0	> 140.0	< 65.0	> 147.0	
AE729T	FTS BAT 2 TEMP	FLOAT	3.1	DEG/F	-0.4	199.6	< 70.0	> 140.0	< 65.0	> 147.0	
ADT205V	ISDS FTS BAT 1 Q1	FLOAT	3.1	VOLTS	0.0	40.0	< 28.0		< 22.0	> 33.0	
ADT207V	ISDS FTS BAT 1 Q2	FLOAT	3.1	VOLTS	0.0	40.0	< 28.0		< 22.0	> 33.0	
ADT206V	ISDS FTS BAT 2 Q1	FLOAT	3.1	VOLTS	0.0	40.0	< 28.0		< 22.0	> 33.0	
ADT208V	ISDS FTS BAT 2 Q2	FLOAT	3.1	VOLTS	0.0	40.0	< 28.0		< 22.0	> 33.0	
ADT213T	FTS BAT 1 Q1 TEMP	FLOAT	3.1	DEG/F	0.0	200.0	< 70.0	>140.0	< 65.0	>147.0	
ADT214T	FTS BAT 2 Q1 TEMP	FLOAT	3.1	DEG/F	0.0	200.0	< 70.0	>140.0	< 65.0	>147.0	
ADT215T	FTS BAT 1 Q2 TEMP	FLOAT	3.1	DEG/F	0.0	200.0	< 70.0	>140.0	< 65.0	>147.0	
ADT216T	FTS BAT 2 Q2 TEMP	FLOAT	3.1	DEG/F	0.0	200.0	< 70.0	>140.0	< 65.0	>147.0	
ADT209V	ISDS FTS BAT 1 Q3	FLOAT	3.1	VOLTS	0.0	40.0	< 28.0		< 22.0	> 33.0	
ADT211V	ISDS FTS BAT 1 Q4	FLOAT	3.1	VOLTS	0.0	40.0	< 28.0		< 22.0	> 33.0	
ADT210V	ISDS FTS BAT 2 Q3	FLOAT	3.1	VOLTS	0.0	40.0	< 28.0		< 22.0	> 33.0	
ADT212V	ISDS FTS BAT 2 Q4	FLOAT	3.1	VOLTS	0.0	40.0	< 28.0		< 22.0	> 33.0	
ADT217T	FTS BAT 1 Q3 TEMP	FLOAT	3.1	DEG/F	0.0	200.0	< 70.0	>140.0	< 65.0	>147.0	
ADT218T	FTS BAT 2 Q3 TEMP	FLOAT	3.1	DEG/F	0.0	200.0	< 70.0	>140.0	< 65.0	>147.0	
ADT219T	FTS BAT 1 Q4 TEMP	FLOAT	3.1	DEG/F	0.0	200.0	< 70.0	>140.0	< 65.0	>147.0	
ADT220T	FTS BAT 2 Q4 TEMP	FLOAT	3.1	DEG/F	0.0	200.0	< 70.0	>140.0	< 65.0	>147.0	

TABLE 3.5. ATLAS IIAS RSTS LATCHING

MEASUREMENT ID	MEASUREMENT DESCRIPTION	Data Type	Display Color		Display Text		Latching State
			OFF	ON	OFF	ON	
CDT182X	FTS RCVR1 DESTRUCT	STATE	GRAY	RED	DESTRUCT	DESTRUCT	
CDT183X	FTS RCVR2 DESTRUCT	STATE	GRAY	RED	DESTRUCT	DESTRUCT	
CDT180X	FTS RCVR 1 MECO	STATE	GRAY	RED	ARM	ARM	
CDT181X	FTS RCVR 2 MECO	STATE	GRAY	RED	ARM	ARM	
CDT192X	PILOT TONE RCVR 1C	STATE	RED	GREEN	PILOT TONE	PILOT TONE	
CDT193X	PILOT TONE RCVR 2C	STATE	RED	GREEN	PILOT TONE	PILOT TONE	
CDT178X	FTS RCVR1 SELF TEST	STATE	GRAY	GREEN	SELF TEST	SELF TEST	
CDT179X	FTS RCVR2 SELF TEST	STATE	GRAY	GREEN	SELF TEST	SELF TEST	
CDT186X	FTS RCVR1 DISABLE	STATE	GRAY	RED	DISABLE	DISABLE	
CDT187X	FTS RCVR2 DISABLE	STATE	GRAY	RED	DISABLE	DISABLE	
CDT188X	FTS RCVR 1 RESET	STATE	GRAY	GREEN	RESET	RESET	
CDT189X	FTS RCVR 2 RESET	STATE	GRAY	GREEN	RESET	RESET	
ADT132X	FTS RCVR1 DESTRUCT	STATE	GRAY	RED	DESTRUCT	DESTRUCT	
ADT133X	FTS RCVR1 DESTRUCT	STATE	GRAY	RED	DESTRUCT	DESTRUCT	
ADT130X	FTS RCVR 1 MECO	STATE	GRAY	RED	ARM	ARM	
ADT131X	FTS RCVR 2 MECO	STATE	GRAY	RED	ARM	ARM	
ADT142X	PILOT TONE RCVR 1A	STATE	RED	GREEN	PILOT TONE	PILOT TONE	
ADT143X	PILOT TONE RCVR 2A	STATE	RED	GREEN	PILOT TONE	PILOT TONE	
ADT128X	FTS RCVR1 SELF TEST	STATE	GRAY	GREEN	SELF TEST	SELF TEST	
ADT129X	FTS RCVR2 SELF TEST	STATE	GRAY	GREEN	SELF TEST	SELF TEST	
ADT136X	FTS RCVR 1 DISABLE	STATE	GRAY	RED	DISABLE	DISABLE	
ADT137X	FTS RCVR 2 DISABLE	STATE	GRAY	RED	DISABLE	DISABLE	
ADT138X	FTS RCVR 1 RESET	STATE	GRAY	GREEN	RESET	RESET	
ADT139X	FTS RCVR 2 RESET	STATE	GRAY	GREEN	RESET	RESET	
ADT237V	ISDS Q1 SAFING RELY	STATE	GRAY	RED	PYC	PYC	
ADT238V	ISDS Q2 SAFING RELY	STATE	GRAY	RED	PYC	PYC	
ADT221X	SRB Q1 S/A SAFED	STATE	GRAY	RED	SAFE	SAFE	
ADT222X	SRB Q2 S/A SAFED	STATE	GRAY	RED	SAFE	SAFE	
ADT229X	SRB Q1 S/A ARMED	STATE	GRAY	GREEN	ARM	ARM	
ADT230X	SRB Q2 S/A ARMED	STATE	GRAY	GREEN	ARM	ARM	
ADT201X	SRB LANYARD SW Q1	STATE	GREEN	RED	LANYARD	LANYARD	
ADT202X	SRB LANYARD SW Q2	STATE	GREEN	RED	LANYARD	LANYARD	

TABLE 3.5. ATLAS IIAS RSTS LATCHING – CONTINUED

MEASUREMENT ID	MEASUREMENT DESCRIPTION	Data Type	Display Color		Display Text		Latching State
			OFF	ON	OFF	ON	
ADT239V	ISDS Q3 SAFING RELY	STATE	GRAY	RED	PYC	PYC	
ADT240V	ISDS Q4 SAFING RELY	STATE	GRAY	RED	PYC	PYC	
ADT223X	SRB Q3 S/A SAFED	STATE	GRAY	RED	SAFE	SAFE	
ADT224X	SRB Q4 S/A SAFED	STATE	GRAY	RED	SAFE	SAFE	
ADT231X	SRB Q3 S/A ARMED	STATE	GRAY	GREEN	ARM	ARM	
ADT232X	SRB Q4 S/A ARMED	STATE	GRAY	GREEN	ARM	ARM	
ADT203X	SRB LANYARD SW Q3	STATE	GREEN	RED	LANYARD	LANYARD	
ADT204X	SRB LANYARD SW Q4	STATE	GREEN	RED	LANYARD	LANYARD	

TABLE 3.6. ATLAS IIAS RSTS GREEN BOARD MEASUREMENT LIST

CENTAUR CRD A	CENTAUR CRD B	BOOSTER CRD A	BOOSTER CRD B	FRAME SYNC	CENTAUR SAFE/ARM	Q 1	Q 2	Q 3	Q 4
CDT182X	CDT183X	ADT132X	ADT133X		CD021X	ADT121X	ADT222X	ADT223X	ADT224X
CDT180X	CDT181X	ADT130X	ADT131X		CD022X	ADT201X	ADT202X	ADT203X	ADT204X
CDT192X	CDT193X	ADT142X	ADT143X			ADT205V	ADT207V	ADT209V	ADT211V
CDT186X	CDT187X	ADT136X	ADT137X	(RESET)	CENTAUR SAFE/ARM	ADT206V	ADT208V	ADT210V	ADT212V
CET021V	CET022V	AET629V	AET630V			ADT213T	ADT215T	ADT217T	ADT219T
CDT170V	CDT171V	ADT120V	ADT121V			ADT214T	ADT216T	ADT218T	ADT220T
CE056T	CE057T	AE728T	AE729T		AD011X				
					AD010X				

NOTE: Measurements are logically “anded.” All measurements must be within tolerance or in a state that signifies a green condition.

TABLE 8.1. ATLAS IIAS ATMOSPHERIC DATA REQUIREMENTS

Assessment	Atmospheric Parameters	Development Time by 30 WS	Data Sent to FSA	FSA Analysis Complete	Requirement
1. L-1 day debris risk	T-0 forecast of wind speed and direction, 0-60,000 ft	8-5 hr prior to LRR	5 hr prior to LRR	2 hr prior to LRR	R
2. L-1 day toxic risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-10,000 ft	N/A	N/A	N/A	NR
3. L-1 day overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A	N/A	N/A	NR
4. RSDS display	Observed wind speed and direction, 0-60,000 ft (met input sent to ROMSSC)	L-8 to L-4:45 hr	Update complete by L-3 hr		R
5. Pre-launch debris risk	Observed wind speed and direction, 0-60,000 ft	L-9 to L-6:05 hr (NLT L-7:05 hr) L-8 to L-3:15 hr (NLT L-4:15 hr) L-4 to L-1:30 hr (NLT L-2:30 hr)	L-5:35 hrs L-2:45 hrs L-1 hr	L-3:15 hrs* L-2:05 hrs* L-30 min	R M M
6. Pre-launch toxic risk	T-0 forecast of wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling and cloud sky coverage for 0-10,000 ft	L-4:30 to L-2:30 hr L-3:30 to L-1:30 hr (all valid T-0 to T+1 hr)	L-2:30 hr L-1:30 hr	L-1:45 hr L-:45 min	R M
7. Pre-launch overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A	N/A	N/A	NR
8. Liftoff toxic hazard	Same as box 6	<u>Developed</u> L-1:30 hr to L-10 min	<u>Valid</u> T-0 to T+10 min	<u>To FSA</u> T-10 min	T-2 mins R
9. Launch delay toxic risk	Same as box 6; valid for 60 min intervals	<u>Developed</u> L-1:30 hr to T-0 T+30 min to T+1:30 hr T+1:00 to T+2:30 hr ... T+3:30 to T+4:30 hr	<u>Valid</u> T+1 to T+2 hr T+2 to T+3 hr T+3 to T+4hr ... T+5 to T+6 hr	<u>To FSA</u> T+30 min T+1:30 hr T+2:30 hr ... T+5:30 hr	30 min after receipt of data M
10. Cat abort toxic hazard	Same as box 6; valid for 15 min intervals	<u>Developed</u> T-0 to T+10 min T+15 to T+30 min	<u>Valid</u> T+15 min to T+30 min T+30 min to T+45 min	<u>To FSA</u> T+15 min T+30 min	ASAP after Cat Abort M
11. Re-constructed T-0 weather profile for toxic analysis	Observed wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling, cloud sky coverage and turbulence measurements for 0-10,000 ft	T-0 to T+24 hr	T+24 hr	N/A	R

*Support tower rollback and cryogenic commit timelines.

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DELTA II

1.0. General. This annex specifies flight control support requirements for Delta II (7320 & 7920) missions. The SMFCO may approve changes to this annex to accommodate operation-peculiar requirements.

2.0. Range Tracking Systems (RTS). Two adequate and independent instrumentation data sources from liftoff through flight control end of mission are MANDATORY.

2.1. Radar. Radars supporting a MANDATORY requirement must be capable of tracking in both skin and transponder modes. A radar slaving source is REQUIRED.

2.1.1. Local. One Vandenberg AFB radar with RF visibility to the launch site and ability to provide quality on-target track of either the booster or transponder no later than three (3) seconds prior to minimum time to endanger (MTE-3 sec) is MANDATORY for liftoff. Data from liftoff is REQUIRED. A second Vandenberg AFB radar is REQUIRED for liftoff.

2.1.2. Remote. One remote radar (downrange and/or crossrange from Vandenberg AFB) is MANDATORY for liftoff.

2.1.3. TNAR Filter. Not required.

2.2. Transponder. A trackable non-coherent C-band transponder on the launch vehicle is MANDATORY.

2.3. Telemetered Inertial Guidance (TMIG). One string of TMIG is MANDATORY and a second string is REQUIRED.

2.4. Global Positioning System (GPS). The use of a GPS translator or receiver shall be considered on a case-by-case basis until adequate experience has been gained to define these requirements. If flown, one string of GPS present position and IIP data is REQUIRED.

3.0. Telemetry. Receipt of telemetered data from the first FTS turn-on through flight control EOM is MANDATORY. One Vandenberg AFB TM site is MANDATORY and one TM site is MANDATORY. A telemetry slaving source is REQUIRED.

4.0. Command. The capture of the CRDs from turn on through flight control EOM is MANDATORY.

4.1. Command systems. A centrally controlled command processing system is MANDATORY. Configure CCS modes as follows:

CCS Mode	Configuration
Operational	Single Non-Redundant
Support	Secure
Failure	Dual

4.2. Command transmitters. Two Vandenberg AFB command transmitters with directional and omni-directional antennas and RF visibility to the launch site are MANDATORY. The primary transmitter system must have line-of-site to the pad. Two remote transmitters (downrange and/or crossrange from Vandenberg AFB) with directional antennas are MANDATORY. Power must be supplied to the MANDATORY command transmitters in such a way so that the loss of a single source of power will not disable both transmitters. Command transmitter site secure code capability is REQUIRED. Elevation of the directional antennas will not be less than three degrees unless directed by the MFCO. Carrier frequency is 416.5 MHz with +/- 30 kHz deviation per tone, Expanded Mode, Monitor 7. Initiate prime CCT switches from local to remote transmitter at T+70 seconds. Initiate local omni to directional antenna switch at T+75 seconds.

4.3. Command slaving source. A real-time slaving source is MANDATORY for the directional antenna at each command transmitter site prime for supporting a MANDATORY command transmitter requirement.

4.4. Command failover. Automatic failover capability connecting all supporting command transmitters is MANDATORY.

4.5. Flight termination system (FTS). A redundant launch vehicle FTS is MANDATORY.

5.0. Displays. The continuous real-time display of launch vehicle performance and system status that affects flight safety is MANDATORY.

5.1. Tracking Display. Two complete Range Safety Display Systems (RSDS) are MANDATORY. Each string will consist of one MANDATORY and one REQUIRED display for the MFCO and one MANDATORY and one REQUIRED display for the RTDC. Display markers for support aircraft, seacraft, oil platforms and unsheltered launch area personnel are REQUIRED. A mission continuation display is REQUIRED.

5.2. MFCO Stripchart Display. Two stripchart recorders are REQUIRED. MFCC stripchart recorder console lights are REQUIRED. Configure the red and green lights above each MFCC stripchart recorder such that the green lights are illuminated when the telemetry bit stream is in sync and the red lights are illuminated when the bit stream is out of sync. MFCC stripchart recorders should be configured for best source display. Configure each stripchart recorder channel for full-scale data display.

5.2.1. Chamber Pressure. Booster chamber pressure telemetry for each engine is REQUIRED. Chamber pressure channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.2. Steering. Vehicle steering (yaw, pitch, roll) is REQUIRED. Steering channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.3. Automatic Gain Control (AGC). Command Receiver Decoder (CRD) AGC levels are REQUIRED. AGC assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments (7320 & 7920).

Table 5.1. MFCC Stripchart Recorder Channel Assignments (7320 & 7920).

[7320]

Recorder #1

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/1	Yaw Output	R
2/2	Pitch Output	R
3/3	Roll Output	R
4/4	Stage 1 Chamber Pressure	R
5/5	Stage 2 Chamber Pressure	R
6/6	(OPEN)	-
7/7	CRD #1 AGC	R
8/8	CRD #2 AGC	R
EVENT/9	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

Recorder #2

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/10	Stage 1 Chamber Pressure	R
2/11	Stage 2 Chamber Pressure	R
3/12	SRM 1 Chamber Pressure	R
4/13	SRM 2 Chamber Pressure	R
5/14	SRM 3 Chamber Pressure	R
6/15	(OPEN)	-
7/16	CRD #1 AGC	R
8/17	CRD #2 AGC	R
EVENT/18	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

[7920]

Recorder #1

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/1	Yaw Output	R
2/2	Pitch Output	R
3/3	Roll Output	R
4/4	Stage 1 Chamber Pressure	R
5/5	SRM 1 Chamber Pressure	R
6/6	SRM 2 Chamber Pressure	R
7/7	SRM 3 Chamber Pressure	R
8/8	SRM 7 Chamber Pressure	R
9/9	SRM 8 Chamber Pressure	R
10/10	SRM 9 Chamber Pressure	R
11/11	CRD #1 AGC	R
12/12	CRD #2 AGC	R
EVENT/13	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

Recorder #2

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/14	Yaw Output	R
2/15	Pitch Output	R
3/16	Roll Output	R
4/17	Stage 1 Chamber Pressure	R
5/18	Stage 2 Chamber Pressure	R
6/19	SRM 4 Chamber Pressure	R
7/20	SRM 5 Chamber Pressure	R
8/21	SRM 6 Chamber Pressure	R
9/22	(OPEN)	-
10/23	(OPEN)	-
11/24	CRD #1 AGC	R
12/25	CRD #2 AGC	R
EVENT/26	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

5.3. FSPO Display. A real-time Range Safety telemetry display for the FSPO, capable of providing data until flight control EOM, is MANDATORY. FSPO display requirements are specified in Table 5.2, FSPO Display Locations & Requirements. RSTS FSPO console data display requirements are specified in Tables 3.3 through 3.6 at the end of this annex. A redundant RSTS console is DESIRED.

Table 5.2. FSPO Display Locations & Requirements.

Blockhouse		RSTS Display		RSTS Stripchart		QLDA-7 W/S	
T-0	Flight	T-0	Flight	T-0	Flight	T-0	Flight
M	R	R	R	R	M	D	D

5.4. Command Status Display. A MFCO status panel is MANDATORY for each active centrally controlled command processing system.

5.5. Attitude Display. Not required.

5.6. Mission Discrete Indicators (MDIs). MDIs are REQUIRED. MDI assignments are specified in Table 5.3, Mission Discrete Indicator Assignments.

Table 5.3. Mission Discrete Indicator Assignments.

<u>Parameter</u>	<u>Display</u>	<u>Display Color</u>	<u>Requirement</u>
TM Synchronization	SYNC	Red	R
Computer Status Word Error	CSW	Red	R
Wild Steering*	STER	Red	R
Hard Maneuvering**	MNVR	Red	R
Stage 2 Ignition	IGN2	Green	R
SRM 2 nd Set Ignition (7920)	SRM2	Green	R
Pilot Tone Monitor, Receiver 1	TONE1	Red	R
Pilot Tone Monitor, Receiver 2	TONE2	Red	R

* - Setup MDI to trigger when all three measurements limits (yaw OR pitch OR roll) are exceeded. Limits are RF-004-XX > 180 degrees; RF-005-XX > 20 degrees; RF-006-XX > 20 degrees.

** - Setup MDI to trigger when any of the three measurement limits are exceeded. Limits are RF-001-XX > 30 degrees; RF-002-XX > 7 degrees; RF-003-XX > 7 degrees.

6.0. Communications.

6.1. Voice Communications. MFCO voice communications are restricted from monitor access by agencies outside 30 SW/SE without written permission.

6.1.1. MFCO Voice Circuits. The MANDATORY and REQUIRED voice networks (nets) and voice direct lines (VDL) listed in Table 6.1, MFCO Voice Circuit Requirements, describe the voice circuit requirements at the MFCO-1 and MFCO-2 consoles. Access by all positions on the MFCO Safety Net is MANDATORY and each position will have talk and continuous monitor capability. CSO is added to the MANDATORY MFCO Safety Net. Table 6.2, RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements, describes the voice circuit requirements at the RSTS-1 and RSTS-2 consoles.

Table 6.1. MFCO Voice Circuit Requirements

Comm Circuit	Requirement	Comm Circuit	Requirement
MFCO Safety Net	M	TMO*	R
Countdown Net	M	FSPO*	R
CCT-1 Net	M	RSTS FSPO*	R
Safety Engineering Net	R	CSO*	R
Range Safety Net	R	LST*	R
CCT-2 Net	R	Program*	R
Emergency Net	R	Back Az*	R
SCMDR Conf Net	R	ROC	R
Safety Radio Net	R	RCO	R
Weather Conf Net	R	ACO*	R
GSFC Launch Coord	R	LWO	R
NASA Safety	R	DCO	R
RCO/Range Coord	R	MCS/MC	R
MFCO-1 (at MFCO-2)*	R	SCMDR	R
MFCO-2 (at MFCO-1)*	R	OD	R
CMD-1*	R	SE	R
CMD-2*	R	Command Post	R
RTDC-1*	R	RC	R
RTDC-2*	R	Class A Line	R

* - Indicates positions with full MFCO Safety Net access.

Table 6.2. RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements

Comm Circuit	RSTS FSPO	RSTS QLDA-7
MFCO Safety Net	M	D (Monitor)
Countdown Net	M	D
Safety Engineering Net	R	-
CCT-1 Net	R	-
CCT-2 Net	R	-
Weather Conf Net	R	-
S/MFCO	R	-
FSPO	R	D
RSTS FSPO	-	D
RCO	R	-
SE	R	-
Class A Line	R	D

6.1.2. Provide one MANDATORY and two REQUIRED Class A telephone lines and one telephone for the Flight Safety Analyst workstation in the MFCC. A Class A telephone line between the

MFCC Toxic Analyst workstation and DC-90 is MANDATORY. Access to a secure telephone in the MFCC is REQUIRED.

6.1.3. LST Communications. The MANDATORY and REQUIRED communication circuits listed in Table 6.3, LST Fallback Communication Access Requirements, will be provided at Building 1762 for all launches utilizing SLC-2W. This communication capability will be available from an outdoor location at Fallback 4. Additionally, this communication capability will be provided within the support facility.

Table 6.3. LST Fallback Communication Access Requirements.

Comm Circuit	Requirement
MFCO Safety Net (T/M)	M
Countdown Net (M)	R
MFCO VDL	R
CSO VDL	R
ACO VDL	R
DCG VDL (Bldg 11165)	R
Class A Line	R

T = Talk capability

M = Monitor

6.1.4. ISB Communications. Range Safety Net and Countdown Net monitors are REQUIRED. A Class A administrative telephone is REQUIRED. Range countdown clock is REQUIRED. CCTV capability is REQUIRED.

6.2. Status/Alert (S&A) System. Status/Alert modules are REQUIRED at each MFCO console from the following positions: CSO, ACO, CMD-1, CMD-2, RTDC-1, RTDC-2, FSPO and RSTS FSPO.

6.3. Closed Circuit Television (CCTV). The following five (simultaneous) displays are REQUIRED on each MFCO console: Program TV, Back Az TV, Boat Plot, ADS and one long-range optic source. Available long-range optic sources may be split between each MFCO position. Best source video is REQUIRED at the ISB post.

6.4. Optics. One long-range optic source is REQUIRED. Two launch area video cameras, identified as Program and Back Az, are REQUIRED. Television van support locations for Program and Back Az are as follows:

Launch Site	Program Site	Back Az Site
SLC-2W	Fallback 4*	JB 69*

* - Indicates visibility to the launch pad

6.5. Missile Lift-off Signal. A positive lift-off indication is REQUIRED.

6.6. Command Communications. The data transmission link between each CCT and the central command system will consist of two MANDATORY and two REQUIRED complete and independent duplex command and status circuits as well as one MANDATORY and one REQUIRED complete and independent duplex pointing data circuits.

6.7. Range Communication.

6.7.1. All mission essential personnel located inside the Impact Limit Line (ILL) will have means to communicate with their control centers and the LST.

6.7.2. The ability to “breakaway” from a launch vehicle anomaly when directed for all supporting aircraft whose Test Support Point (TSP) lies within the ILL is MANDATORY. The ability to receive this communication is REQUIRED. If this communication capability is lost, “no-radio” (NORDO) procedures will be implemented, which shall include a return to base procedure to avoid closed airspace (impact boxes and up range hazard and caution areas).

6.8. Clocks. Visibility by all console positions within the Mission Flight Control Center (MFCC) to UTC, range countdown and pad clocks is REQUIRED.

7.0. Data Processing. The systems that process metric and telemetry data for output to MFCC displays are at the same level of decision authority as are required for the data to be displayed. Processing and transfer of weather data to MFCC systems are required at the levels of decision authority as specified in Appendix D, Delta II Weather System and Instrumentation Support Plan.

8.0. Meteorological. Receipt of weather data is MANDATORY and/or REQUIRED, as specified in Table 8.1, Delta II Atmospheric Data Requirements.

8.1. Local Atmospheric Data. See Table 8.1, Delta II Atmospheric Data Requirements.

8.2. Launch Commit Criteria. The Weather Aircraft is REQUIRED. Launch will not occur if weather conditions violate MANDATORY safety constraints for natural and triggered lightning, or triboelectrification, as described in Appendix C, Range Safety Weather Launch Commit Criteria.

8.3. Post Operation. See Table 8.1, Delta II Atmospheric Data Requirements.

9.0. Area Clearance. Clearance of all non-mission essential personnel from areas under 30 SW surveillance and control is MANDATORY.

9.1. On-shore Surface. Clearance of all non-mission essential personnel from land areas within the ILL, including the Union Pacific Railroad (UPRR) right-of-way, is MANDATORY. UPRR clearance is as follows (subject to day-of-launch real-time analysis):

Launch Site	Clearance Area
SLC-2W	8N-18S

9.2. Offshore Surface. Clearance of danger zones and hazard areas, including uprange impact areas, is MANDATORY.

9.3. Airspace. Clearance of non-mission essential aircraft from launch safety airspace is MANDATORY.

9.4. Surveillance. A surveillance helicopter is REQUIRED. The UPRR Trainmaster is REQUIRED. NAWC boat support is REQUIRED.

9.5. Recovery. Location (longitude and latitude), report of physical condition, and recovery of nozzle closures (when safe and environmentally sound) is REQUIRED.

10.0. Data Requirements. All items are REQUIRED. See Table 10.1, Data Requirements.

Table 10.1. Data Requirements.

Data Item	Title	Data	Deliver
380.00	Post Launch Analysis Of Radar Systems, Letter Report	PLARS Report	17 WD
401.00	Video Cassette Recording	Format: SVHS (DVD is DESIRED) Time: T-90 seconds - LOV Video: Composite of Program, Back Az, LA-24, Santa Ynez, Pad/MST, Vehicle on-board Audio: Ch 1 MFCO Safety Net; Ch 2 IRIG-B	3 WD
416.00	Single Channel Voice Recording	Voice-operated MFCO communications	On Request
927.00	Events Display Recording – Range Safety	MFCC MFCO Stripchart Recorders 1 & 2	30 Minutes
928.00	Events Display Recording – Flight Safety	MFCC RSTS Stripchart Recorders 1 & 2	30 Minutes

TABLE 3.2. DELTA II RSTS FSPO STRIPCHART SETUP SHEET

FSPO-1FSPO-2

Channel No.	Description	Type	Range Low	Range High	Channel No.	Description	Type	Range Low	Range High
1 SYNC	FRAME SYNC	S	0 OFF	1 ON	1 SYNC	FRAME SYNC	S	0 OFF	1 ON
2 GA021M	AGC A	A	0 Volts	5 Volts	2 GA021M	AGC A	A	0 Volts	5 Volts
3 GB005M6	CK 4 A	D	0	1	3 GB005M6	CK 4 A	D	0	1
4 GB004M8	ARM A	D	0	1	4 GB004M8	ARM A	D	0	1
5 GB001K2	DESTRUCT A	D	0	1	5 GB001K2	DESTRUCT A	D	0	1
6 GA029M	AGC B	A	0 Volts	5 Volts	6 GA029M	AGC B	A	0 Volts	5 Volts
7 GB005M5	CK 4 B	D	0	1	7 GB005M5	CK 4 B	D	0	1
8 GB004M7	ARM B	D	0	1	8 GB004M7	ARM B	D	0	1
9 GB001K2	DESTRUCT B	D	0	1	9 GB001K1	DESTRUCT B	D	0	1
10					10				
11					11				
12					12				
13					13				
14					14				
15					15				
16					16				
17					17				
18					18				
19					19				
20					20				
21					21				
22					22				
23					23				
24					24				
25					25				
26					26				
27					27				
28					28				
29					29				
30					30				
31					31				
32	TIMING	IRIG B			32	TIMING	IRIG B		

TABLE 3.3. DELTA II RSTS DISPLAY EXAMPLE

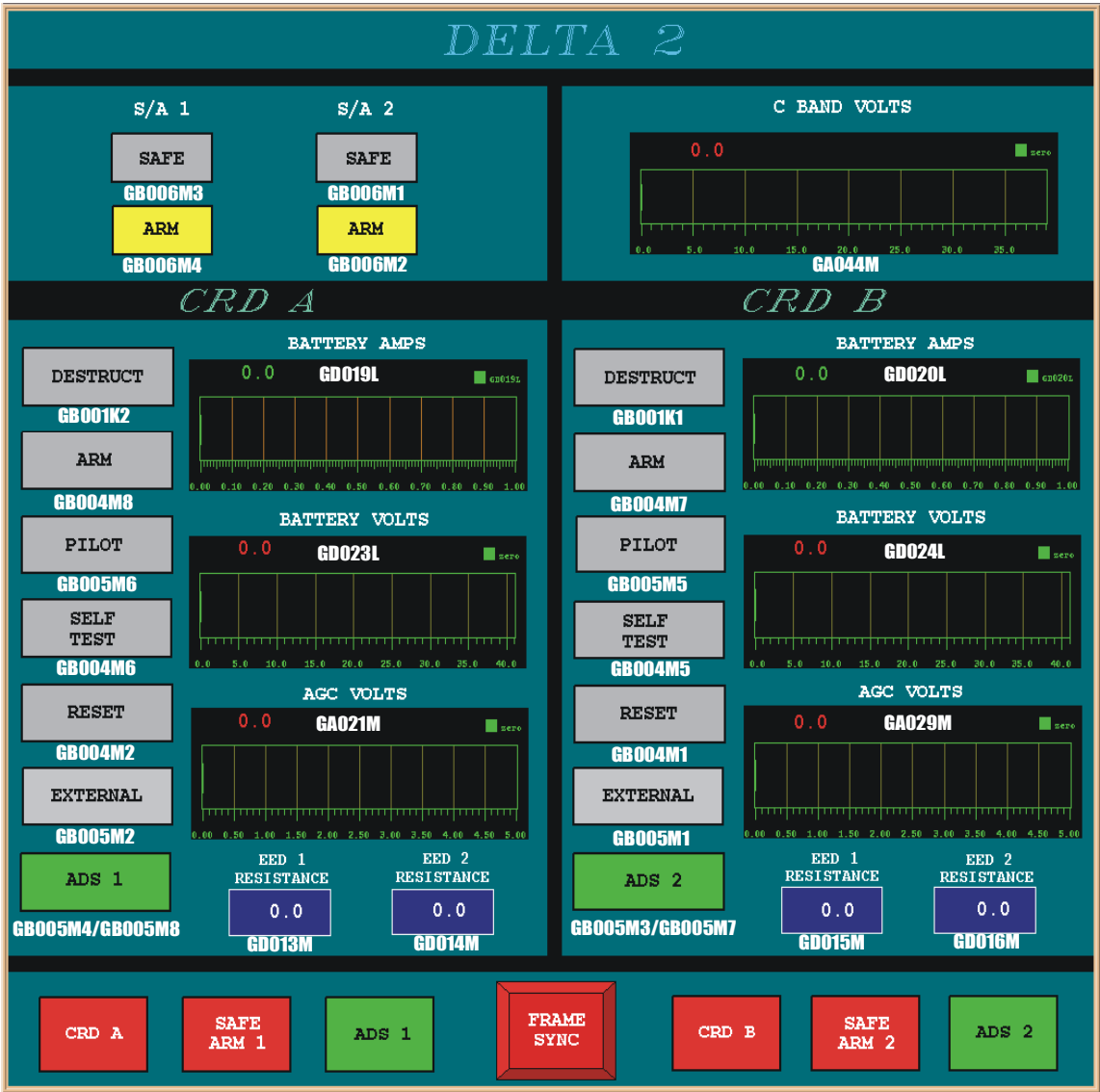


TABLE 3.4. DELTA II RSTS LIMITS

Measure- ment ID	MEASUREMENT DESCRIPTION	Data Type	Resolution	Units	Display Range		Limit Checking				Latching State
							YELLOW		RED		
GA021MX	CRD 1 AGC	FLOAT	3.1	VOLTS	0.0	5.0			< 1.0		
GA029MX	CRD 2 AGC	FLOAT	3.1	VOLTS	0.0	5.0			< 1.0		
GD013MX	CRD 1 EED 1	FLOAT	3.1	OHMS	0.0	175.0				> 10.0	> 10.0
GD014MX	CRD 1 EED 2	FLOAT	3.1	OHMS	0.0	175.0				> 10.0	> 10.0
GD015MX	CRD 2 EED 1	FLOAT	3.1	OHMS	0.0	175.0				> 10.0	> 10.0
GD016MX	CRD 2 EED 2	FLOAT	3.1	OHMS	0.0	175.0				> 10.0	> 10.0
GD019LX	CRD 1 BAT AMPS	FLOAT	3.1	AMPS	0.0	1.0					
GD020LX	CRD 2 BAT AMPS	FLOAT	3.1	AMPS	0.0	1.0					
GD023LX	CRD 1 BAT VOLTS	FLOAT	3.1	VOLTS	0.0	41.0	< 30.0	> 22.0	< 22.0	> 33.0	
GD024LX	CRD 2 BAT VOLTS	FLOAT	3.1	VOLTS	0.0	41.0	< 30.0	> 22.0	< 22.0	> 33.0	
GA044MX	C-BAND VOLTS	FLOAT	3.1	VOLTS	0.0	41.0	< 28.0	> 23.0	< 23.0		

TABLE 3.5. DELTA II RSTS LATCHING

Measure- ment ID	MEASUREMENT DESCRIPTION	Data Type	Display Color		Display Text		Latching State
			OFF	ON	OFF	ON	
GB001K1	CRD 2 DESTRUCT	STATE	GRAY	RED	DESTRUCT	DESTRUCT	
GB001K2	CRD 1 DESTRUCT	STATE	GRAY	RED	DESTRUCT	DESTRUCT	
GB004M1	CRD 2 RESET	STATE	GRAY	GREEN	RESET	RESET	
GB004M2	CRD 1 RESET	STATE	GRAY	GREEN	RESET	RESET	
GB004M5 ¹	CRD 2 SELF TEST	STATE	GRAY	GREEN	SELF TEST	SELF TEST	
GB004M6 ¹	CRD 1 SELF TEST	STATE	GRAY	GREEN	SELF TEST	SELF TEST	
GB004M7	CRD 2 ARM	STATE	GRAY	RED	ARM	ARM	
GB004M8	CRD 1 ARM	STATE	GRAY	RED	ARM	ARM	
GB005M1	CRD 2 INTERNAL	STATE	GRAY	GREEN	INTERNAL	INTERNAL	
GB005M2	CRD 1 INTERNAL	STATE	GRAY	GREEN	INTERNAL	INTERNAL	
GB005M3 ²	CRD 2 ADS 1	STATE	GREEN	RED	ADS 2	ADS 2	
GB005M4 ³	CRD 1 ADS 1	STATE	GREEN	RED	ADS 1	ADS 1	
GB005M5	CRD 2 PILOT TONE	STATE	GRAY	GREEN	PILOT TONE	PILOT TONE	
GB005M6	CRD 1 PILOT TONE	STATE	GRAY	GREEN	PILOT TONE	PILOT TONE	
GB005M7	CRD 2 ADS 2	STATE	GREEN	RED	ADS 2	ADS 2	
GB005M8	CRD 1 ADS 2	STATE	GREEN	RED	ADS 1	ADS 1	
GB006M1	CRD 2 S/A SAFE	STATE	GRAY	YELLOW	SAFE	SAFE	
GB006M2	CRD 2 S/A ARM	STATE	GRAY	GREEN	ARM	ARM	
GB006M3	CRD 1 S/A SAFE	STATE	GRAY	YELLOW	SAFE	SAFE	
GB006M4	CRD 1 S/A ARM	STATE	GRAY	GREEN	ARM	ARM	

NOTES:

¹ Self-Test performed at power up & following self test command. Passed self-test indicated by Self Test Tm high for 5 1 sec. & then low for 1 ± 0.5 sec.

² TM low after CRD ADS Safe # 2 received, or after CRD power up. ADS is safe when either one or both ADS SAFE/ARM monitors are low.

³ TM low after CRD ADS Safe # 1 received, or after CRD power up. ADS is safe when either one or both ADS SAFE/ARM monitors are low.

TABLE 3.6. DELTA II RSTS GREEN BOARD MEASUREMENT LIST

CRD A	SAFE/ARM 1	ADS 1	FRAME SYNC	CRD B	SAFE/ARM 2	ADS 2
GB001K2	GB006M3	GB005M4		GB001K1	GB006M1	GB005M3
GB004M8	GB006M4	GB005M8		GB004M7	GB006M2	GB005M7
GB005M6			(RESET)	GB005M5		
GB004M6				GB004M5		
GB004M2				GB004M1		
GB005M2				GB005M1		
GD023L				GD024L		
GD013M				GD015M		
GD014M				GD016M		
GA021M				GA029M		

NOTES:

1. Measurements are logically “anded.” All measurements must be within tolerance or in a state that signifies a green condition.
2. ADS 1 and 2 are safe when either one or both of the ADS monitors are low.

TABLE 8.1. DELTA II ATMOSPHERIC DATA REQUIREMENTS

Assessment	Atmospheric Parameters	Development Time by 30 WS		Data Sent to FSA	FSA Analysis Complete	Requirement
1. L-1 day debris risk	T-0 forecast of wind speed and direction, 0-60,000 ft	8-5 hr prior to LRR		5 hr prior to LRR	2 hr prior to LRR	R
2. L-1 day toxic risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-10,000 ft	N/A		N/A	N/A	NR
3. L-1 day overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A		N/A	N/A	NR
4. RSDS display	Observed wind speed and direction, 0-60,000 ft (met input sent to ROMSSC)	T-8 to T-4:45 hr		Update complete by T-3 hr		R
5. Pre-launch debris risk	Observed wind speed and direction, 0-60,000 ft	T-8 to T-5 hr (NLT T-6 hr) T-4 to T-1:30 hr (NLT T-2:30 hr)		T-4:30 hr T-1 hr	T-3 hr T-30 min	M M
6. Pre-launch toxic risk	T-0 forecast of wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling and cloud sky coverage for 0-10,000 ft	T-4:30 to T-2:30 hr T-3:30 to T-1:30 hr (all valid T-0 to T+1 hr)		T-2:30 hr T-1:30 hr	T-1:45 hr T-:45 min	R M
7. Pre-launch overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A		N/A	N/A	NR
8. Liftoff toxic hazard	Same as box 6	<u>Developed</u> T-1:30 hr to T-10 min	<u>Valid</u> T-0 to T+10 min	<u>To FSA</u> T-10 min	T-2 mins	R
9. Launch delay toxic risk	Same as box 6; valid for 60 min intervals	<u>Developed</u> T-1:30 hr to T-0 T+30 min to T+1:30 hr T+1:00 to T+2:30 hr ... T+3:30 to T+4:30 hr	<u>Valid</u> T+1 to T+2 hr T+2 to T+3 hr T+3 to T+4hr ... T+5 to T+6 hr	<u>To FSA</u> T+30 min T+1:30 hr T+2:30 hr ... T+5:30 hr	30 min after receipt of data	M
10. Cat abort toxic hazard	Same as box 6; valid for 15 min intervals	<u>Developed</u> T-0 to T+10 min T+15 to T+30 min	<u>Valid</u> T+15 min to T+30 min T+30 min to T+45 min	<u>To FSA</u> T+15 min T+30 min	ASAP after Cat Abort	M
11. Re-constructed T-0 weather profile for toxic analysis	Observed wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling, cloud sky coverage and turbulence measurements for 0-10,000 ft	T-0 to T+24 hr		T+24 hr	N/A	R

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TITAN II

1.0. General. This annex specifies flight control support requirements for Titan II missions. The SMFCO may approve changes to this annex to accommodate operation-peculiar requirements.

2.0. Range Tracking Systems (RTS). Two adequate and independent instrumentation data sources from liftoff through flight control end of mission are MANDATORY.

2.1. Radar. Radars supporting a MANDATORY requirement must be capable of tracking in both skin and transponder modes. A radar slaving source is REQUIRED.

2.1.1. Local. One Vandenberg AFB radar with RF visibility to the launch site and ability to provide quality on-target track of either the booster or transponder no later than three (3) seconds prior to minimum time to endanger (MTE-3 sec) is MANDATORY for liftoff. Data from liftoff is REQUIRED. A second Vandenberg AFB radar is REQUIRED for liftoff.

2.1.2. Remote. Not required.

2.1.3. TNAR Filter. Not required.

2.2. Transponder. A trackable non-coherent C-band transponder on the launch vehicle is MANDATORY.

2.3. Telemetered Inertial Guidance (TMIG). One string of TMIG is MANDATORY and a second string is REQUIRED.

2.4. Global Positioning System (GPS). The use of a GPS translator or receiver shall be considered on a case-by-case basis until adequate experience has been gained to define these requirements. If flown, one string of GPS present position and IIP data is REQUIRED.

3.0. Telemetry. Receipt of telemetered data from the first FTS turn-on through flight control EOM is MANDATORY. One Vandenberg AFB TM site is MANDATORY. A telemetry slaving source is REQUIRED.

4.0. Command. The capture of the CRDs from turn on through flight control EOM is MANDATORY.

4.1. Command systems. A centrally controlled command processing system is MANDATORY. Configure CCS modes as follows:

CCS Mode	Configuration
Operational	Single Non-Redundant
Support	Secure
Failure	Dual

4.2. Command transmitters. Two Vandenberg AFB command transmitters with directional and omni-directional antennas and RF visibility to the launch site are MANDATORY. The primary transmitter system must have line-of-site to the pad. Remote transmitters are not required. Power must be supplied to the MANDATORY command transmitters in such a way so that the loss of a single source of power will not disable both transmitters. Command transmitter site secure code capability is REQUIRED. Elevation of the directional antennas will not be less than three degrees unless directed by the MFCO. Carrier frequency is 416.5 MHz with +/- 30 kHz deviation per tone, Expanded Mode, Monitor 7. Initiate local omni to directional antenna switch at T+75 seconds.

4.3. Command slaving source. A real-time slaving source is MANDATORY for the directional antenna at each command transmitter site prime for supporting a MANDATORY command transmitter requirement.

4.4. Command failover. Automatic failover capability connecting all supporting command transmitters is MANDATORY.

4.5. Flight termination system (FTS). A redundant launch vehicle FTS is MANDATORY.

5.0. Displays. The continuous real-time display of launch vehicle performance and system status that affects flight safety is MANDATORY.

5.1. Tracking Display. Two complete Range Safety Display Systems (RSDS) are MANDATORY. Each string will consist of one MANDATORY and one REQUIRED display for the MFCO and one MANDATORY and one REQUIRED display for the RTDC. Display markers for support aircraft, seacraft, oil platforms and unsheltered launch area personnel are REQUIRED. A mission continuation display is REQUIRED.

5.2. MFCO Stripchart Display. Two stripchart recorders are REQUIRED. MFCC stripchart recorder console lights are REQUIRED. Configure the red and green lights above each MFCC stripchart recorder such that the green lights are illuminated when the telemetry bit stream is in sync and the red lights are illuminated when the bit stream is out of sync. MFCC stripchart recorders should be configured for best source display. Configure each stripchart recorder channel for full-scale data display.

5.2.1. Chamber Pressure. Booster chamber pressure telemetry for each engine is REQUIRED. Chamber pressure channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.2. Steering. Vehicle steering (yaw, pitch, roll) is REQUIRED. Steering channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.3. Automatic Gain Control (AGC). Command Receiver Decoder (CRD) AGC levels are REQUIRED. AGC assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

Table 5.1. MFCC Stripchart Recorder Channel Assignments.

Recorder #1

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/1	Yaw Rate	R
2/2	Pitch Rate	R
3/3	Roll Rate	R
4/4	Stage 1 TCA 1 Chamber Pressure	R
5/5	Stage 1 TCA 2 Chamber Pressure	R
6/6	Stage 2 Chamber Pressure	R
7/7	AGC Command Receiver 1	R
8/8	AGC command receiver 2	R
EVENT/9	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

Recorder #2

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/10	Yaw Rate	R
2/11	Pitch Rate	R
3/12	Roll Rate	R
4/13	Stage 1 TCA 1 Chamber Pressure	R
5/14	Stage 1 TCA 2 Chamber Pressure	R
6/15	Stage 2 Chamber Pressure	R
7/16	AGC Command Receiver 1	R
8/17	AGC command receiver 2	R
EVENT/18	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

5.3. FSPO Display. A real-time Range Safety telemetry display for the FSPO, capable of providing data until flight control EOM, is MANDATORY. FSPO display requirements are specified in Table 5.2, FSPO Display Locations & Requirements. RSTS FSPO console data display requirements are specified in Tables 3.3 through 3.6 at the end of this annex. A redundant RSTS console is DESIRED.

Table 5.2. FSPO Display Locations & Requirements.

Blockhouse		RSTS Display		RSTS Stripchart		QLDA-7 W/S	
T-0	Flight	T-0	Flight	T-0	Flight	T-0	Flight
M	N/C	R	R	R	M	D	D

5.4. Command Status Display. A MFCO status panel is MANDATORY for each active centrally controlled command processing system.

5.5. Attitude Display. Not required.

5.6. Mission Discrete Indicators (MDIs). MDIs are REQUIRED. MDI assignments are specified in Table 5.3, Mission Discrete Indicator Assignments.

Table 5.3. Mission Discrete Indicator Assignments.

<u>Parameter</u>	<u>Display</u>	<u>Display Color</u>	<u>Requirement</u>
TM Synchronization	SYNC	Red	R
Stage 1 Destruct Arm Indicator	1ARM	Red	R
Stage 2 Destruct Arm Indicator	2ARM	Red	R
Inertial Measurement Unit Alarm	IMUA	Red	R
Guidance Computer Alarm	MGCA	Red	R
Pilot Tone Monitor, Receiver 1	TONE1	Red	R
Pilot Tone Monitor, Receiver 2	TONE2	Red	R

6.0. Communications.

6.1. Voice Communications. MFCO voice communications are restricted from monitor access by agencies outside 30 SW/SE without written permission.

6.1.1. MFCO Voice Circuits. The MANDATORY and REQUIRED voice networks (nets) and voice direct lines (VDL) listed in Table 6.1, MFCO Voice Circuit Requirements, describe the voice circuit requirements at the MFCO-1 and MFCO-2 consoles. Access by all positions on the MFCO Safety Net is MANDATORY and each position will have talk and continuous monitor capability. Table 6.2, RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements, describes the voice circuit requirements at the RSTS-1 and RSTS-2 consoles.

Table 6.1. MFCO Voice Circuit Requirements

Comm Circuit	Requirement	Comm Circuit	Requirement
MFCO Safety Net	M	RSTS FSPO*	R
Countdown Net	M	OSM*	R
CCT-1 Net	M	LST*	R
Safety Engineering Net	R	Program*	R
Range Safety Net	R	Back Az*	R
CCT-2 Net	R	ROC	R
Emergency Net	R	RCO	R
SCMDR Conf Net	R	ACO*	R
Safety Radio Net	R	LWO	R
Weather Conf Net	R	DCO	R

AF Crew	R	MCS/MC	R
PRN	R	SCMDR	R
MFCO-1 (at MFCO-2)*	R	OD	R
MFCO-2 (at MFCO-1)*	R	SE	R
CMD-1*	R	Command Post	R
CMD-2*	R	T&FS	R
RTDC-1*	R	AFLD	R
RTDC-2*	R	AFLC	R
TMO*	R	Class A Line	R
FSPO*	R		

* - Indicates positions with full MFCO Safety Net access.

Table 6.2. RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements

Comm Circuit	RSTS FSPO	RSTS QLDA-7
MFCO Safety Net	M	D (Monitor)
Countdown Net	M	D
Safety Engineering Net	R	-
CCT-1 Net	R	-
CCT-2 Net	R	-
Weather Conf Net	R	-
S/MFCO	R	-
FSPO	R	D
RSTS FSPO	-	D
RCO	R	-
SE	R	-
Class A Line	R	D

6.1.2. Provide one MANDATORY and two REQUIRED Class A telephone lines and one telephone for the Flight Safety Analyst workstation in the MFCC. A Class A telephone line between the MFCC Toxic Analyst workstation and DC-90 is MANDATORY. Access to a secure telephone in the MFCC is REQUIRED.

6.1.3. LST Communications. The MANDATORY and REQUIRED communication circuits listed in Table 6.3, LST Fallback Communication Access Requirements, will be provided at Fallback 9 for all launches utilizing SLC-4W. This communication capability will be available from an outdoor location at Fallback 9. Additionally, this communication capability will be provided within the support facility.

Table 6.3. LST Fallback Communication Access Requirements.

Comm Circuit	Requirement
MFCO Safety Net (T/M)	M
Countdown Net (M)	R
MFCO VDL	R
OSM VDL	R
ACO VDL	R
DCG VDL (Bldg 11165)	R
Class A Line	R

T = Talk capability M = Monitor

6.1.4. ISB Communications. Range Safety Net and Countdown Net monitors are REQUIRED. A Class A administrative telephone is REQUIRED. Range countdown clock is REQUIRED. CCTV capability is REQUIRED.

6.2. Status/Alert (S&A) System. Status/Alert modules are REQUIRED at each MFCO console from the following positions: OSM, ACO, CMD-1, CMD-2, RTDC-1, RTDC-2, FSPO and RSTS FSPO.

6.3. Closed Circuit Television (CCTV). The following five (simultaneous) displays are REQUIRED on each MFCO console: Program TV, Back Az TV, Boat Plot, ADS and one long-range optic source. Available long-range optic sources may be split between each MFCO position. Best source video is REQUIRED at the ISB post.

6.4. Optics. One long-range optic source is REQUIRED. Two launch area video cameras, identified as Program and Back Az, are REQUIRED. Television van support locations for Program and Back Az are as follows:

Launch Site	Program Site	Back Az Site
SLC-4W	JB 539	<200° 506*/502 (TV)* ≥200° 502*

* - Indicates visibility to the launch pad

6.5. Missile Lift-off Signal. A positive lift-off indication is REQUIRED.

6.6. Command Communications. The data transmission link between each CCT and the central command system will consist of two MANDATORY and two REQUIRED complete and independent duplex command and status circuits as well as one MANDATORY and one REQUIRED complete and independent duplex pointing data circuits.

6.7. Range Communication.

6.7.1. All mission essential personnel located inside the Impact Limit Line (ILL) will have means to communicate with their control centers and the LST.

6.7.2. The ability to “breakaway” from a launch vehicle anomaly when directed for all supporting aircraft whose Test Support Point (TSP) lies within the ILL is MANDATORY. The ability to receive this communication is REQUIRED. If this communication capability is lost, “no-radio” (NORDO) procedures will be implemented, which shall include a return to base procedure to avoid closed airspace (impact boxes and up range hazard and caution areas).

6.8. Clocks. Visibility by all console positions within the Mission Flight Control Center (MFCC) to UTC, range countdown and pad clocks is REQUIRED.

7.0. Data Processing. The systems that process metric and telemetry data for output to MFCC displays are at the same level of decision authority as are required for the data to be displayed. Processing and transfer of weather data to MFCC systems are required at the levels of decision authority as specified in Appendix D, Titan II Weather System and Instrumentation Support Plan.

8.0. Meteorological. Receipt of weather data is MANDATORY and/or REQUIRED, as specified in Table 8.1, Titan II Atmospheric Data Requirements.

8.1. Local Atmospheric Data. See Table 8.1, Titan II Atmospheric Data Requirements.

8.2. Launch Commit Criteria. The Weather Aircraft is REQUIRED. Launch will not occur if weather conditions violate MANDATORY safety constraints for natural and triggered lightning, or triboelectrification, as described in Appendix C, Range Safety Weather Launch Commit Criteria.

8.3. Post Operation. See Table 8.1, Titan II Atmospheric Data Requirements.

9.0. Area Clearance. Clearance of all non-mission essential personnel from areas under 30 SW surveillance and control is MANDATORY.

9.1. On-shore Surface. Clearance of all non-mission essential personnel from land areas within the ILL, including the Union Pacific Railroad (UPRR) right-of-way, is MANDATORY. UPRR clearance is as follows (subject to day-of-launch real-time analysis):

Launch Site	Clearance Area
SLC-4W	<190° Surf-34S ≥190° Surf-18S

9.2. Offshore Surface. Clearance of danger zones and hazard areas, including uprange impact areas, is MANDATORY.

9.3. Airspace. Clearance of non-mission essential aircraft from launch safety airspace is MANDATORY.

9.4. Surveillance. A surveillance helicopter is REQUIRED. The UPRR Trainmaster is REQUIRED. NAWC boat support is REQUIRED.

9.5. Recovery. Not required.

10.0. Data Requirements. All items are REQUIRED. See Table 10.1, Data Requirements.

Table 10.1. Data Requirements.

Data Item	Title	Data	Deliver
380.00	Post Launch Analysis Of Radar Systems, Letter Report	PLARS Report	17 WD
401.00	Video Cassette Recording	Format: SVHS (DVD is DESIRED) Time: T-90 seconds - LOV Video: Composite of Program, Back Az, LA-24, Santa Ynez, Pad/MST Audio: Ch 1 MFCO Safety Net; Ch 2 IRIG-B	3 WD
416.00	Single Channel Voice Recording	Voice-operated MFCO communications (Compact Disc)	On Request
927.00	Events Display Recording – Range Safety	MFCC MFCO Stripchart Recorders 1 & 2	30 Minutes
928.00	Events Display Recording – Flight Safety	MFCC RSTS Stripchart Recorders 1 & 2	30 Minutes

TABLE 3.2. TITAN II RSTS FSPO STRIPCHART SETUP SHEET

FSPO-1FSPO-2

Channel No.	Description	Type	Range Low	Range High	Channel No.	Description	Type	Range Low	Range High
1 SYNC	FRAME SYNC	S	0 OFF	1 ON	1 SYNC	FRAME SYNC	S	0 OFF	1 ON
2 1002	AGC A	A	0 Volts	5 Volts	2 1002	AGC A	A	0 Volts	5 Volts
3 1010	PILOT A	D	0	1	3 1010	PILOT A	D	0	1
4 1008	ARM A/B	A	0 Volts	35 Volts	4 1008	ARM A/B	A	0 Volts	35 Volts
5 1002	DESTRUCT A	A	0 Volts	5 Volts	5 1002	DESTRUCT A	A	0 Volts	5 Volts
6 1125	CDS 1 BUS	A	0 Volts	49.7 Volts	6 1125	CDS 1 BUS	A	0 Volts	49.7 Volts
7					7				
8 1006	AGC B	A	0 Volts	5 Volts	8 1006	AGC B	A	0 Volts	5 Volts
9 1012	PILOT B	D	0	1	9 1012	PILOT B	D	0	1
10 1006	DESTRUCT B	A	0 Volts	5 Volts	10 1006	DESTRUCT B	A	0 Volts	5 Volts
11 1126	CDS 2 BUS	A	0 Volts	35 Volts	11 1126	CDS 2 BUS	A	0 Volts	35 Volts
12					12				
13					13				
14					14				
15					15				
16					16				
17					17				
18					18				
19					19				
20					20				
21					21				
22					22				
23					23				
24					24				
25					25				
26					26				
27					27				
28					28				
29					29				
30					30				
31					31				
32	TIMING	IRIG B			32	TIMING	IRIG B		

TABLE 3.3. TITAN II RSTS DISPLAY EXAMPLE

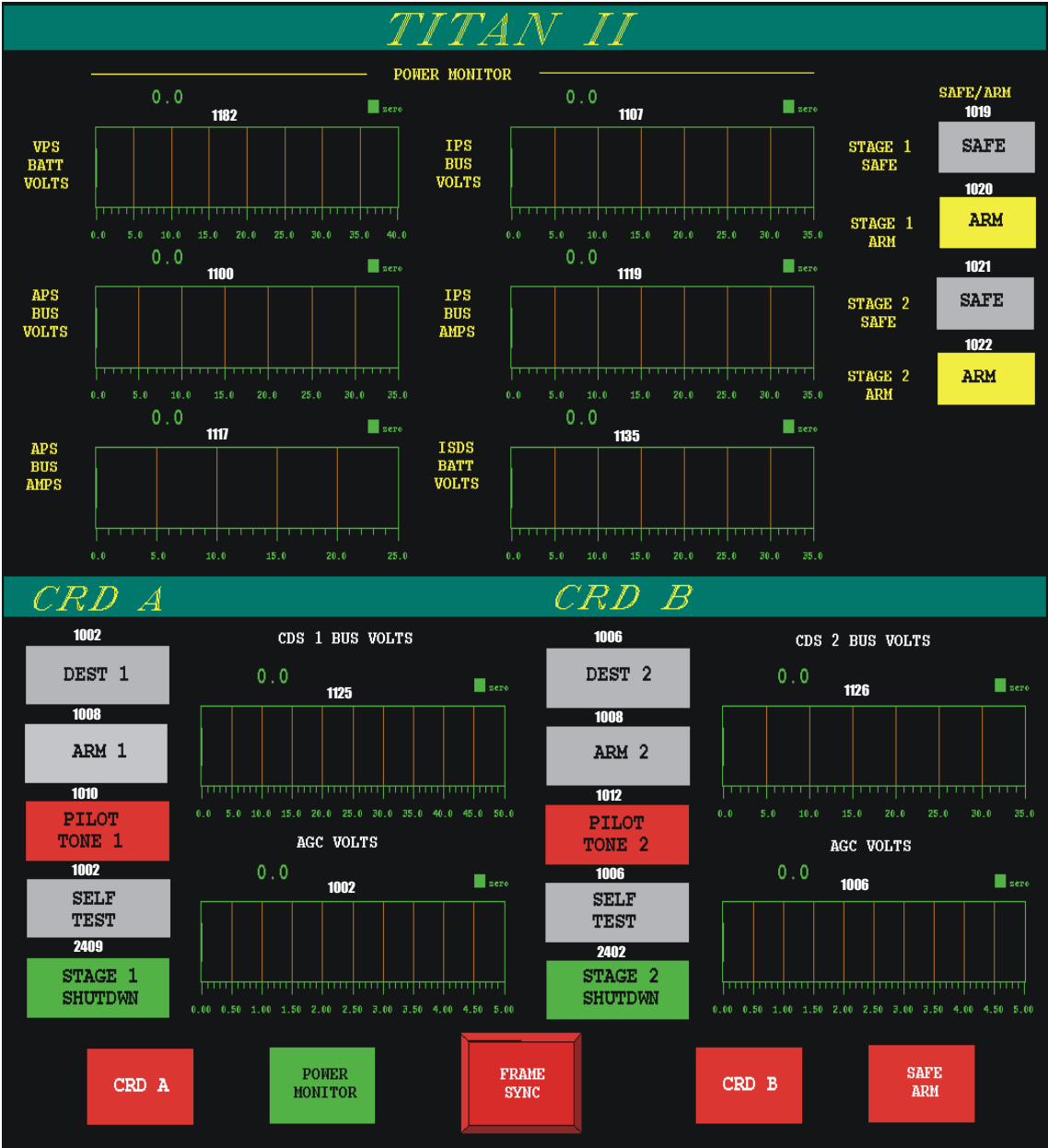


TABLE 3.4. TITAN II RSTS LIMITS

Measurement ID	MEASUREMENT DESCRIPTION	Data Type	Resolution	Units	Display Range		S&A Safe/Arm	Limit Checking		Latching State
					Low	High		Red		
								Low	High	
1002	RCVR 1 AGC	FLOAT	3.1	VOLTS	0.0	5.0		< 0.125	> 4.75	
1006	RCVR 2 AGC	FLOAT	3.1	VOLTS	0.0	5.0		< 0.125	> 4.75	
1010	PILOT TONE 1	STATE		ON/OFF	0	1		< 1		
1012	PILOT TONE 2	STATE		ON/OFF	0	1		< 1		
1019	STG 1 SAFE/ARM SAFE	FLOAT	3.1	VOLTS	0.0	35.0	Stage 1 Safe			
							Stage 1 Arm	< 22.3		
1020	STG 1 SAFE/ARM ARM	FLOAT	3.1	VOLTS	0.0	35.0	Stage 1 Safe	< 22.3		
							Stage 1 Arm			
1021	STG 2 SAFE/ARM SAFE	FLOAT	3.1	VOLTS	0.0	35.0	Stage II Safe			
							Stage II Arm	< 22.3		
1022	STG 2 SAFE/ARM ARM	FLOAT	3.1	VOLTS	0.0	35.0	Stage I Safe	< 22.3		
							Stage II Arm			
1125	CCPS #1 BUS	FLOAT	3.1	VOLTS	0.0	49.7		< 23.25	> 36.75	
1126	CCPS #2 BUS	FLOAT	3.1	VOLTS	0.0	35.0		< 22.4		
1135	STG 1 ISDS BATT	FLOAT	3.1	VOLTS	0.0	35.0		< 24.4		
1008	RCVR 1 ARM	FLOAT	3.1	VOLTS	0.0	35.0		< 16.5	> 19.5	
1008	RCVR 2 ARM	FLOAT	3.1	VOLTS	0.0	35.0		< 7.5	> 10.5	
1008	RCVR 1& 2 ARM	FLOAT	3.1	VOLTS	0.0	35.0		< 25.5	> 29.5	
1100	APS BATT.	FLOAT	3.1	VOLTS	0.0	35.0		< 27.4	> 30.83	
1119	IPS BUS CURRENT	FLOAT	3.1	AMPS	0.0	25.0		< 4.5	> 9.2	
1107	IPS BUS VOLTAGE	FLOAT	3.1	VOLTS	0.0	35.0		< 26.8	> 30.83	
1117	APS BUS CURRENT	FLOAT	3.1	AMPS	0.0	25.0		< 0.33	> 3.2	
1182	VPS BATT	FLOAT	3.1	VOLTS	0.0	41.0		< 26.0	> 36.2	
2402	STG 2 SHUTDOWN	FLOAT	3.1	VOLTS	0.0	35.0		< 18.0		< 18.0
2409	STG 1 SHUTDOWN	FLOAT	3.1	VOLTS	0.0	35.0		< 18.0		< 18.0

TABLE 3.5. TITAN II RSTS LATCHING

Measure- ment ID	MEASUREMENT DESCRIPTION	Data Type	Display Color		Display Text		Latching State
			OFF	ON	OFF	ON	
1002	RCVR 1 AGC	FLOAT	GRAY	RED	DEST 1	DEST 1	
1006	RCVR 2 AGC	FLOAT	GRAY	RED	DEST 2	DEST 2	
1008 ¹	RCVR 1 ARM	FLOAT	GRAY	GREEN	ARM 1	ARM 1	
1008 ¹	RCVR 2 ARM	FLOAT	GRAY	GREEN	ARM 2	ARM 2	
1010	PILOT TONE 1	STATE	RED	GREEN	PILOT TONE 1	PILOT TONE 1	
1012	PILOT TONE 2	STATE	RED	GREEN	PILOT TONE 2	PILOT TONE 2	
1002	SELF TEST	FLOAT	GRAY	RED	SELF TEST	SELF TEST	
1006	SELF TEST	FLOAT	GRAY	RED	SELF TEST	SELF TEST	
2409	STG 1 SHUTDOWN	FLOAT	RED	GREEN	STG 1 SHUTDOWN	STG 1 SHUTDOWN	OFF
2402	STG 2 SHUTDOWN	FLOAT	RED	GREEN	STG 2 SHUTDOWN	STG 2 SHUTDOWN	OFF
1019	STG 1 SAFE/ARM SAFE	FLOAT	GREEN	GRAY	SAFE	ARM	
1020	STG 1 SAFE/ARM ARM	FLOAT	GREEN	YELLOW	ARM	SAFE	
1021	STG 2 SAFE/ARM SAFE	FLOAT	GREEN	GRAY	SAFE	ARM	
1022	STG 2 SAFE/ARM ARM	FLOAT	GREEN	YELLOW	ARM	SAFE	

¹NOTES:

1. CRD B Arm illuminate (GREEN) if 1008 is greater than 7.5 and less than 10.5 (nominal 9.0)
2. CRD A Arm illuminate (GREEN) if 1008 is greater than 16.5 and less than 19.5 (nominal 18.0)
3. Both CRD A and B Arm illuminate (GREEN) if 1008 is greater than 25.5 and less than 29.5 (nominal 27.0)

TABLE 3.6. TITAN II RSTS GREEN BOARD MEASUREMENT LIST

CRD A		POWER MONITOR		FRAME SYNC		CRD B		SAFE ARM
1010		1182				1012		1019
1125		1107		(RESET)		1126		1020
1002		1100				1006		
1008		1119				1008		1021
1008		1117				1008		1022
2409		1135				2402		

NOTES:

1. Measurements are logically “anded.” All measurements must be within tolerance or in a state that signifies a green condition.
2. Measurement 1008 conditions (receiver 1 and 2 shutdown).
3. CRD B Arm illuminate (GREEN) if 1008 is greater than 7.5 and less than 10.5 (nominal 9.0)
4. CRD A Arm illuminate (GREEN) if 1008 is greater than 16.5 and less than 19.5 (nominal 18.0)
5. Both CRD A and B Arm illuminate (GREEN) if 1008 is greater than 25.5 and less than 29.5 (nominal 27.0)
6. Safe/Arm illuminate for stage 1 if 1019 is greater than xx.xx and 1020 is less than xx.xx, OR
Safe/Arm illuminate for stage 2 if 1021 is greater than xx.xx and 1022 is less than xx.xx

TABLE 8.1. TITAN II ATMOSPHERIC DATA REQUIREMENTS

Assessment	Atmospheric Parameters	Development Time by 30 WS	Data Sent to FSA	FSA Analysis Complete	Requirement
1. L-1 day debris risk	T-0 forecast of wind speed and direction, 0-60,000 ft	8-5 hr prior to LRR	5 hr prior to LRR	2 hr prior to LRR	R
2. L-1 day toxic risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-10,000 ft	6-3 hr prior to LRR	3 hr prior to LRR	2 hr prior to LRR	R
3. L-1 day overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A	N/A	N/A	NR
4. RSDS display	Observed wind speed and direction, 0-60,000 ft (met input sent to ROMSSC)	T-8 to T-4:45 hr	Update complete by T-3 hr		R
5. Pre-launch debris risk	Observed wind speed and direction, 0-60,000 ft	T-8 to T-5 hr (NLT T-6 hr) T-4 to T-1:30 hr (NLT T-2:30 hr)	T-4:30 hr T-1 hr	T-3 hr T-30 min	M M
6. Pre-launch toxic risk	T-0 forecast of wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling and cloud sky coverage for 0-10,000 ft	T-6:30 to T-4:30 hr T-5:30 to T-3:30 hr T-4:30 to T-2:30 hr T-3:30 to T-1:30 hr (all valid T-0 to T+1 hr)	T-4:30 hr T-3:30 hr T-2:30 hr T-1:30 hr	T-3:45 hr T-2:45 hr T-1:45 hr T-:45 min	R R R M
7. Pre-launch overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A	N/A	N/A	NR
8. Liftoff toxic hazard	Same as box 6	<u>Developed</u> T-1:30 hr to T-10 min	<u>Valid</u> T-0 to T+10 min	<u>To FSA</u> T-10 min	T-2 mins R
9. Launch delay toxic risk	Same as box 6; valid for 60 min intervals	<u>Developed</u> T-1:30 hr to T-0 T+30 min to T+1:30 hr T+1:00 to T+2:30 hr ... T+3:30 to T+4:30 hr	<u>Valid</u> T+1 to T+2 hr T+2 to T+3 hr T+3 to T+4hr ... T+5 to T+6 hr	<u>To FSA</u> T+30 min T+1:30 hr T+2:30 hr ... T+5:30 hr	30 min after receipt of data M
10. Cat abort toxic hazard	Same as box 6; valid for 15 min intervals	<u>Developed</u> T-0 to T+10 min T+15 to T+30 min	<u>Valid</u> T+15 min to T+30 min T+30 min to T+45 min	<u>To FSA</u> T+15 min T+30 min	ASAP after Cat Abort M
11. Re-constructed T-0 weather profile for toxic analysis	Observed wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling, cloud sky coverage and turbulence measurements for 0-10,000 ft	T-0 to T+24 hr	T+24 hr	N/A	R

TITAN IV-B

1.0. General. This annex specifies flight control support requirements for Titan IV-B missions. The SMFCO may approve changes to this annex to accommodate operation-peculiar requirements.

2.0. Range Tracking Systems (RTS). Two adequate and independent instrumentation data sources from liftoff through flight control end of mission are MANDATORY.

2.1. Radar. Radars supporting a MANDATORY requirement must be capable of tracking in both skin and transponder modes. A radar slaving source is REQUIRED.

2.1.1. Local. One Vandenberg AFB radar with RF visibility to the launch site and ability to provide quality on-target track of either the booster or transponder no later than three (3) seconds prior to minimum time to endanger (MTE-3 sec) is MANDATORY for liftoff. Data from liftoff is REQUIRED. A second Vandenberg AFB radar is REQUIRED for liftoff.

2.1.2. Remote. One remote radar (downrange and/or crossrange from Vandenberg AFB) is MANDATORY for liftoff.

2.1.3. TNAR Filter. Not required.

2.2. Transponder. A trackable non-coherent C-band transponder on the launch vehicle is MANDATORY.

2.3. Telemetered Inertial Guidance (TMIG). One string of TMIG is MANDATORY and a second string is REQUIRED.

2.4. Global Positioning System (GPS). The use of a GPS translator or receiver shall be considered on a case-by-case basis until adequate experience has been gained to define these requirements. If flown, one string of GPS present position and IIP data is REQUIRED.

3.0. Telemetry. Receipt of telemetered data from the first FTS turn-on through flight control EOM is MANDATORY. One Vandenberg AFB TM site is MANDATORY and one TM site is MANDATORY. A telemetry slaving source is REQUIRED.

4.0. Command. The capture of the CRDs from turn on through flight control EOM is MANDATORY.

4.1. Command systems. A centrally controlled command processing system is MANDATORY. Configure CCS modes as follows:

CCS Mode	Configuration
Operational	Single Non-Redundant
Support	Secure
Failure	Dual

4.2. Command transmitters. Two Vandenberg AFB command transmitters with directional and omni-directional antennas and RF visibility to the launch site are MANDATORY. The primary transmitter system must have line-of-site to the pad. Two remote transmitters (downrange and/or crossrange from Vandenberg AFB) with directional antennas are MANDATORY. Power must be supplied to the MANDATORY command transmitters in such a way so that the loss of a single source of power will not disable both transmitters. Command transmitter site secure code capability is REQUIRED. Elevation of the directional antennas will not be less than three degrees unless directed by the MFCO. Carrier frequency is 416.5 MHz with +/- 30 kHz deviation per tone, Expanded Mode, Monitor 7. Initiate prime CCT switches from local to remote transmitter at T+50 sec. Initiate local omni to directional antenna switch at T+55 seconds.

4.3. Command slaving source. A real-time slaving source is MANDATORY for the directional antenna at each command transmitter site prime for supporting a MANDATORY command transmitter requirement.

4.4. Command failover. Automatic failover capability connecting all supporting command transmitters is MANDATORY.

4.5. Flight termination system (FTS). A redundant launch vehicle FTS is MANDATORY.

5.0. Displays. The continuous real-time display of launch vehicle performance and system status that affects flight safety is MANDATORY.

5.1. Tracking Display. Two complete Range Safety Display Systems (RSDS) are MANDATORY. Each string will consist of one MANDATORY and one REQUIRED display for the MFCO and one MANDATORY and one REQUIRED display for the RTDC. Display markers for support aircraft, seacraft, oil platforms and unsheltered launch area personnel are REQUIRED. A mission continuation display is REQUIRED.

5.2. MFCO Stripchart Display. Two stripchart recorders are REQUIRED. MFCC stripchart recorder console lights are REQUIRED. Configure the red and green lights above each MFCC stripchart recorder such that the green lights are illuminated when the telemetry bit stream is in sync and the red lights are illuminated when the bit stream is out of sync. MFCC stripchart recorders should be configured for best source display. Configure each stripchart recorder channel for full-scale data display.

5.2.1. Chamber Pressure. Booster chamber pressure telemetry for each engine is REQUIRED. Chamber pressure channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.2. Steering. Vehicle steering (yaw, pitch, roll) is REQUIRED. Steering channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.3. Automatic Gain Control (AGC). Command Receiver Decoder (CRD) AGC levels are REQUIRED. AGC assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

Table 5.1. MFCC Stripchart Recorder Channel Assignments.

Recorder #1

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/1	Yaw Rate	R
2/2	Pitch Rate	R
3/3	Roll Rate	R
4/4	Spare	R
5/5	SRMU 1 Chamber Pressure	R
6/6	SRMU 2 Chamber Pressure	R
7/7	AGC Command Receiver 1	R
8/8	AGC Command Receiver 2	R
EVENT/9	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

Recorder #2

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/10	Yaw Rate	R
2/11	Pitch Rate	R
3/12	Roll Rate	R
4/13	Stage 2 Chamber Pressure	R
5/14	Stage 1 TCA #1 Chamber Pressure	R
6/15	Stage 1 TCA #2 Chamber Pressure	R
7/16	AGC Command Receiver 1	R
8/17	AGC Command Receiver 2	R
EVENT/18	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

5.3. FSPO Display. A real-time Range Safety telemetry display for the FSPO, capable of providing data until flight control EOM, is MANDATORY. FSPO display requirements are specified in Table 5.2, FSPO Display Locations & Requirements. RSTS FSPO console data display requirements are specified in Tables 3.3 through 3.6 at the end of this annex. A redundant RSTS console is DESIRED.

Table 5.2. FSPO Display Locations & Requirements.

Blockhouse		RSTS Display		RSTS Stripchart		QLDA-7 W/S	
T-0	Flight	T-0	Flight	T-0	Flight	T-0	Flight
M	D	R	R	R	M	D	D

5.4. Command Status Display. A MFCO status panel is MANDATORY for each active centrally controlled command processing system.

5.5. Attitude Display. A vehicle attitude display is REQUIRED on each string of RSDS.

5.6. Mission Discrete Indicators (MDIs). MDIs are REQUIRED. MDI assignments are specified in Table 5.3, Mission Discrete Indicator Assignments.

Table 5.3. Mission Discrete Indicator Assignments.

<u>Parameter</u>	<u>Display</u>	<u>Display Color</u>	<u>Requirement</u>
TM Synchronization	SYNC	Red	R
Guidance to Inertial	MGOI	Green	R
Fairing Separation	FSEP	Green	R
SRMU Destruct Arm Indicator	SRMU	Green	R
Core Destruct Arm Indicator	CORE	Green	R
IMU Status Alarm	IMSA	Red	R
Vehicle Erratic Flight*	VERR	Red	R
Pilot Tone Monitor, Receiver 1	TONE1	Red	R
Pilot Tone Monitor, Receiver 2	TONE2	Red	R

* - Setup MDI to trigger when all three measurements (yaw AND pitch AND roll) are exceeded. Values of +/- 8 degrees have been coordinated with LMA.

6.0. Communications.

6.1. Voice Communications. MFCO voice communications are restricted from monitor access by agencies outside 30 SW/SE without written permission.

6.1.1. MFCO Voice Circuits. The MANDATORY and REQUIRED voice networks (nets) and voice direct lines (VDL) listed in Table 6.1, MFCO Voice Circuit Requirements, describe the voice circuit requirements at the MFCO-1 and MFCO-2 consoles. Access by all positions on the MFCO Safety Net is MANDATORY and each position will have talk and continuous monitor capability. Table 6.2, RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements, describes the voice circuit requirements at the RSTS-1 and RSTS-2 consoles.

Table 6.1. MFCO Voice Circuit Requirements

Comm Circuit	Requirement	Comm Circuit	Requirement
MFCO Safety Net	M	RSTS FSPO*	R
Countdown Net	M	OSM*	R
CCT-1 Net	M	LST*	R
Safety Engineering Net	R	Program*	R
Range Safety Net	R	Back Az*	R
CCT-2 Net	R	ROC	R
Emergency Net	R	RCO	R
SCMDR Conf Net	R	ACO*	R
Safety Radio Net	R	LWO	R
Weather Conf Net	R	DCO	R
AF Crew	R	MCS/MC	R
PRN	R	SCMDR	R
MFCO-1 (at MFCO-2)*	R	OD	R
MFCO-2 (at MFCO-1)*	R	SE	R
CMD-1*	R	Command Post	R
CMD-2*	R	T&FS	R
RTDC-1*	R	AFLD	R
RTDC-2*	R	AFLC	R
TMO*	R	Class A Line	R
FSPO*	R		

* - Indicates positions with full MFCO Safety Net access.

Table 6.2. RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements

Comm Circuit	RSTS FSPO	RSTS QLDA-7
MFCO Safety Net	M	D (Monitor)
Countdown Net	M	D
Safety Engineering Net	R	-
CCT-1 Net	R	-
CCT-2 Net	R	-
Weather Conf Net	R	-
S/MFCO	R	-
FSPO	R	D
RSTS FSPO	-	D
RCO	R	-
SE	R	-
Class A Line	R	D

6.1.2. Provide one MANDATORY and two REQUIRED Class A telephone lines and one telephone for the Flight Safety Analyst workstation in the MFCC. A Class A telephone line between the MFCC Toxic Analyst workstation and DC-90 is MANDATORY. Access to a secure telephone in the MFCC is REQUIRED.

6.1.3. LST Communications. The MANDATORY and REQUIRED communication circuits listed in Table 6.3, LST Fallback Communication Access Requirements, will be provided at Fallback 9 for all launches utilizing SLC-4E. This communication capability will be available from an outdoor location at Fallback 9. Additionally, this communication capability will be provided within the support facility.

Table 6.3. LST Fallback Communication Access Requirements.

Comm Circuit	Requirement
MFCO Safety Net (T/M)	M
Countdown Net (M)	R
MFCO VDL	R
OSM VDL	R
ACO VDL	R
DCG VDL (Bldg 11165)	R
Class A Line	R

T = Talk capability

M = Monitor

6.1.4. ISB Communications. Range Safety Net and Countdown Net monitors are REQUIRED. A Class A administrative telephone is REQUIRED. Range countdown clock is REQUIRED. CCTV capability is REQUIRED.

6.2. Status/Alert (S&A) System. Status/Alert modules are REQUIRED at each MFCO console from the following positions: OSM, ACO, CMD-1, CMD-2, RTDC-1, RTDC-2, FSPO and RSTS FSPO.

6.3. Closed Circuit Television (CCTV). The following five (simultaneous) displays are REQUIRED on each MFCO console: Program TV, Back Az TV, Boat Plot, ADS and one long-range optic source. Available long-range optic sources may be split between each MFCO position. Best source video is REQUIRED at the ISB post.

6.4. Optics. One long-range optic source is REQUIRED. Two launch area video cameras, identified as Program and Back Az, are REQUIRED. Television van support locations for Program and Back Az are as follows:

Launch Site	Program Site	Back Az Site
SLC-4E	539	<200° 506*/502 (TV)* ≥200° 502*

* - Indicates visibility to the launch pad

6.5. Missile Lift-off Signal. A positive lift-off indication is REQUIRED.

6.6. Command Communications. The data transmission link between each CCT and the central command system will consist of two MANDATORY and two REQUIRED complete and independent duplex command and status circuits as well as one MANDATORY and one REQUIRED complete and independent duplex pointing data circuits.

6.7. Range Communication.

6.7.1. All mission essential personnel located inside the Impact Limit Line (ILL) will have means to communicate with their control centers and the LST.

6.7.2. The ability to “breakaway” from a launch vehicle anomaly when directed for all supporting aircraft whose Test Support Point (TSP) lies within the ILL is MANDATORY. The ability to receive this communication is REQUIRED. If this communication capability is lost, "no-radio" (NORDO) procedures will be implemented, which shall include a return to base procedure to avoid closed airspace (impact boxes and up range hazard and caution areas).

6.8. Clocks. Visibility by all console positions within the Mission Flight Control Center (MFCC) to UTC, range countdown and pad clocks is REQUIRED.

7.0. Data Processing. The systems that process metric and telemetry data for output to MFCC displays are at the same level of decision authority as are required for the data to be displayed. Processing and transfer of weather data to MFCC systems are required at the levels of decision authority as specified in Appendix D, Titan IV-B Weather System and Instrumentation Support Plan.

8.0. Meteorological. Receipt of weather data is MANDATORY and/or REQUIRED, as specified in Table 8.1, Titan IV-B Atmospheric Data Requirements.

8.1. Local Atmospheric Data. See Table 8.1, Titan IV-B Atmospheric Data Requirements.

8.2. Launch Commit Criteria. The Weather Aircraft is REQUIRED. Launch will not occur if weather conditions violate MANDATORY safety constraints for natural and triggered lightning, or triboelectrification, as described in Appendix C, Range Safety Weather Launch Commit Criteria.

8.3. Post Operation. See Table 8.1, Titan IV-B Atmospheric Data Requirements.

9.0. Area Clearance. Clearance of all non-mission essential personnel from areas under 30 SW surveillance and control is MANDATORY.

9.1. On-shore Surface. Clearance of all non-mission essential personnel from land areas within the ILL, including the Union Pacific Railroad (UPRR) right-of-way, is MANDATORY. UPRR clearance is as follows (subject to day-of-launch real-time analysis):

Launch Site	Clearance Area
SLC-4E	<190° Surf-31S ≥190° Surf-18S

9.2. Offshore Surface. Clearance of danger zones and hazard areas, including uprange impact areas, is MANDATORY.

9.3. Airspace. Clearance of non-mission essential aircraft from launch safety airspace is MANDATORY.

9.4. Surveillance. A surveillance helicopter is REQUIRED. The UPRR Trainmaster is REQUIRED. NAWC boat support is REQUIRED.

9.5. Recovery. Not required.

10.0. Data Requirements. All items are REQUIRED. See Table 10.1, Data Requirements.

Table 10.1. Data Requirements.

Data Item	Title	Data	Deliver
380.00	Post Launch Analysis Of Radar Systems, Letter Report	PLARS Report	17 WD
401.00	Video Cassette Recording	Format: SVHS (DVD is DESIRED) Time: T-90 seconds - LOV Video: Composite of Program, Back Az, LA-24, Santa Ynez, Pad/MST Audio: Ch 1 MFCO Safety Net; Ch 2 IRIG-B	3 WD
416.00	Single Channel Voice Recording	Voice-operated MFCO communications (Compact Disc)	On Request
927.00	Events Display Recording – Range Safety	MFCC MFCO Stripchart Recorders 1 & 2	30 Minutes
928.00	Events Display Recording – Flight Safety	MFCC RSTS Stripchart Recorders 1 & 2	30 Minutes

TABLE 3.2. TITAN IV-B RSTS FSPO STRIPCHART SETUP SHEET

FSPO-1FSPO-2

Channel No.	Description	Type	Range Low	Range High	Channel No.	Description	Type	Range Low	Range High
1	SYNC	FRAME SYNC	S	0 OFF 1 ON	1	SYNC	FRAME SYNC	S	0 OFF 1 ON
2	TET02	AGC A	A	0 Volts 5.08 Volts	2	TET02	AGC A	A	0 Volts 5.08 Volts
3	TDT10	CK 4 A	D	0 1	3	TDT10	CK 4 A	D	0 1
4	TET08	ARM A	A	-2 Volts 38.64 Volts	4	TET08	ARM A	A	-2 Volts 38.64 Volts
5	TET02	DESTRUCT A	A	0 Volts 5.08 Volts	5	TET02	DESTRUCT A	A	0 Volts 5.08 Volts
6	TC225	CDS 1 BUS	A	-2 Volts 38.64 Volts	6	TC225	CDS 1 BUS	A	-2 Volts 38.64 Volts
7	TE203	CDS 1 BATT	A	0 Volts 35 Volts	7	TE203	CDS 1 BATT	A	0 Volts 35 Volts
8	TET06	AGC B	A	0 Volts 5.08 Volts	8	TET06	AGC B	A	0 Volts 5.08 Volts
9	TDT12	CK 4 B	D	0 1	9	TDT12	CK 4 B	D	0 1
10	TET09	ARM B	A	-2 Volts 38.64 Volts	10	TET09	ARM B	A	-2 Volts 38.64 Volts
11	TET06	DESTRUCT B	A	0 Volts 5.08 Volts	11	TET06	DESTRUCT B	A	0 Volts 5.08 Volts
12	TC226	CDS 2 BUS	A	-2 Volts 38.64 Volts	12	TC226	CDS 2 BUS	A	-2 Volts 38.64 Volts
13	TE205	CDS 2 BATT	A	0 Volts 35 Volts	13	TE205	CDS 2 BATT	A	0 Volts 35 Volts
14					14				
15					15				
16					16				
17					17				
18					18				
19					19				
20					20				
21					21				
22					22				
23					23				
24					24				
25					25				
26					26				
27					27				
28					28				
29					29				
30					30				
31					31				
32	TIMING	IRIG A			32	TIMING	IRIG A		

TABLE 3.3. TITAN IV-B RSTS DISPLAY EXAMPLE



TABLE 3.4. TITAN IV-B RSTS LIMITS

MEASUREMENT ID	MEASUREMENT DESCRIPTION	Data Type	Resolution	Units	Display Range		Limit Checking				Latching State
							YELLOW		RED		
TEA30	SRMU1A S/A	FLOAT	3.1	CNTS	0	254			< 127		
TEA31	SRMU1B S/A	FLOAT	3.1	CNTS	0	254			< 127		
TEAB1	SRMU1A BATT	FLOAT	3.1	VOLTS	-2.2	42.9			< 26.0	> 34.0	
TEAB2	SRMU1B BATT	FLOAT	3.1	VOLTS	-2.2	42.9			< 26.0	> 34.0	
TEB30	SRMU2A S/A	FLOAT	3.1	CNTS	0	254			< 127		
TEB31	SRMU2B S/A	FLOAT	3.1	CNTS	0	254			< 127		
TEBB1	SRMU2A BATT	FLOAT	3.1	VOLTS	-2.2	42.9			< 26.0	> 34.0	
TEBB2	SRMU2B BATT	FLOAT	3.1	VOLTS	-2.2	42.9			< 26.0	> 34.0	
TE111	STG 1A S/A	FLOAT	3.1	VOLTS	-2.3	45.2			<.5		
TE122	STG 1B S/A	FLOAT	3.1	VOLTS	-2.3	45.2			< .5		
TE112	STG 1A DEST	FLOAT	3.1	VOLTS	-3.3	45.2				> 5.0	
TE113	STG 1B DEST	FLOAT	3.1	VOLTS	-3.3	45.2				> 5.0	
TE114	STG 1A TRIG	FLOAT	3.1	VOLTS	-2.3	45.2				> 5.0	
TE115	STG 1B TRIG	FLOAT	3.1	VOLTS	-2.3	45.2				> 5.0	
TE135	STG 1A BAT	FLOAT	3.1	VOLTS	-2.3	45.2			< 26.6	> 33.4	
TE137	STG 1B BAT	FLOAT	3.1	VOLTS	-2.3	45.2			< 26.6	> 33.4	
TT102	STG 1A TEMP	FLOAT	3.1	DEG/F	15.42	160.0			< 89.0	>121.0	
TT104	STG 1B TEMP	FLOAT	3.1	DEG/F	15.42	160.0			< 89.0	>121.0	
TE251	STG 2A S/A	FLOAT	3.1	VOLTS	-2.3	45.2			< .5		
TE261	STG 2B S/A	FLOAT	3.1	VOLTS	-2.3	45.2			< .5		
TE252	STG 2A DEST	FLOAT	3.1	VOLTS	-2.3	45.2				> 5.0	
TE253	STG 2B DEST	FLOAT	3.1	VOLTS	-2.3	45.2				> 5.0	
TE254	STG 2A TRIG	FLOAT	3.1	VOLTS	-2.3	45.2			< 5.0		
TE255	STG 2B TRIG	FLOAT	3.1	VOLTS	15.42	160.0			< 26.6	> 33.4	
TE235	STG 2A BAT	FLOAT	3.1	VOLTS	-2.3	45.2			< 26.6	> 33.4	
TE237	STG 2B BAT	FLOAT	3.1	VOLTS	-2.3	45.2			< 26.6	> 33.4	
TT204	STG 2A TEMP	FLOAT	3.1	DEGF	15.42	160.0			< 89.0	>121.0	
TT208	STG 2B TEMP	FLOAT	3.1	DEGF	15.42	160.0			< 89.0	> 121.0	

TABLE 3.4. TITAN IV-B RSTS LIMITS - CONTINUED

MEASUREMENT ID	MEASUREMENT DESCRIPTION	Data Type	Resolution	Units	Display Range		Limit Checking				Latching State
							YELLOW		RED		
TET02	CRD 1	FLOAT	3.1	VOLTS	0.0	8.1			< 2.5		
TET06	CRD 2	FLOAT	3.1	VOLTS	0.0	8.1			< 2.5		
TET08	CRD 1 S/D CMD	FLOAT	3.1	VOLTS	0.0	39.0			< 26.0	> 33.4	
TET09	CRD 2 S/D CMD	FLOAT	3.1	VOLTS	0.0	39.0			< 26.4	> 33.4	
TE225	FTS CDS 1 BUS	FLOAT	3.1	VOLTS	0.0	39.0			< 24.4	> 32.8	
TE226	FTS CDS 2 BUS	FLOAT	3.1	VOLTS	0.0	39.0			< 24.4	> 32.8	
TC225	FTS CURR CDS 1 BUS	FLOAT	3.1	AMPS	0.0	1.0					
TC226	FTS CURR CDS 2 BUS	FLOAT	3.1	AMPS	0.0	1.0					
TE203	FTS OCV CDS 1	FLOAT	3.1	VOLTS	0.0	40.0			< 24.6	> 33.0	
TE205	FTS OCV CDS 2	FLOAT	3.1	VOLTS	0.0	40.0			< 24.6	> 33.0	
TT230	FTS TEMP CDS 1 BAT	FLOAT	3.1	DEG/F	15.42	160.0			< 89.0	>121.0	
TT232	FTS TEMP CDS 2 BAT	FLOAT	3.1	DEG/F	15.42	160.0			< 89.0	> 121.0	
TTA25	SRMU1 ADS BATT A	FLOAT	3.1	DEG/F	15.42	160.0			< 89.0	>121.0	
TTA26	SRMU1 ADS BATT B	FLOAT	3.1	DEG/F	15.42	160.0			< 89.0	>121.0	
TTB27	SRMU2 ADS BATT A	FLOAT	3.1	DEG/F	15.42	160.0			< 89.0	>121.0	
TTB28	SRMU2 ADS BATT B	FLOAT	3.1	DEG/F	15.42	160.0			< 89.0	>121.0	

TABLE 3.5. TITAN IV-B RSTS LATCHING

MEASUREMENT ID	MEASUREMENT DESCRIPTION	Data Type	Display Color		Display Text		Latching State
			ON	OFF	OFF	ON	
TDAF1	SRMU1 FTC1 HOT LINE	STATE	RED	GREEN	HOT LINE	HOT LINE	
TDAF2	SRMU1 FTC2 HOT LINE	STATE	RED	GREEN	HOT LINE	HOT LINE	
TDAF3	SRMU1 FTC1 ARM	STATE	RED	GRAY	FTC SAFE	FTC ARM	
TDAF4	SRMU1 FTC2 ARM	STATE	RED	GRAY	FTC SAFE	FTC ARM	
TDAF5	SRMU1 FTC1 DESTR	STATE	RED	GRAY	FTC DEST	FTC DEST	
TDAF6	SRMU1 FTC2 DESTR	STATE	RED	GRAY	FTC DEST	FTC DEST	
TDAF7	SRMU1 FTC1 TRIGGER	STATE	RED	GREEN	FTC TRIG	FTC TRIG	
TDAF8	SRMU1 FTC2 TRIGGER	STATE	RED	GREEN	FTC TRIG	FTC TRIG	
TTA25	SRMU1 ADS BATTERY A	STATE	RED	GREEN	BATT TEMP	BATT TEMP	
TTA26	SRMU1 ADS BATTERY B	STATE	RED	GREEN	BATT TEMP	BATT TEMP	
TDBF1	SRMU2 FTC1 HOT LINE	STATE	RED	GREEN	HOT LINE	HOT LINE	
TDBF2	SRMU2 FTC2 HOT LINE	STATE	RED	GREEN	HOT LINE	HOT LINE	
TDBF3	SRMU2 FTC1 ARM	STATE	RED	GRAY	FTC SAFE	FTC ARM	
TDBF4	SRMU2 FTC2 ARM	STATE	RED	GRAY	FTC SAFE	FTC ARM	
TDBF5	SRMU2 FTC1 DESTR	STATE	RED	GRAY	FTC DEST	FTC DEST	
TDBF6	SRMU2 FTC2 DESTR	STATE	RED	GRAY	FTC DEST	FTC DEST	
TDBF7	SRMU2 FTC1 TRIGGER	STATE	RED	GREEN	FTC TRIG	FTC TRIG	
TDBF8	SRMU2 FTC2 TRIGGER	STATE	RED	GREEN	FTC TRIG	FTC TRIG	
TE111	STG 1 FTC1 ARM	STATE	GREEN	RED	FTC SAFE	FTC ARM	
TE122	STG 1 FTC2 ARM	STATE	GREEN	RED	FTC SAFE	FTC ARM	
TE251	STG 2 FTC1 ARM	STATE	GREEN	RED	FTC SAFE	FTC ARM	
TE261	STG 2 FTC2 ARM	STATE	GREEN	RED	FTC SAFE	FTC ARM	
TEA30	SRMU1 SAFE/ARM 1	STATE	RED	GREEN	S/A SAFE	S/A ARM	
TEA31	SRMU1 SAFE/ARM 2	STATE	RED	GREEN	S/A SAFE	S/A ARM	
TEB30	SRMU2 SAFE/ARM 1	STATE	RED	GREEN	S/A SAFE	S/A ARM	
TEB31	SRMU2 SAFE/ARM 2	STATE	RED	GREEN	S/A SAFE	S/A ARM	
TTB25	SRMU2 ADS BATTERY A	STATE	RED	GREEN	BATT TEMP	BATT TEMP	
TTB26	SRMU2 ADS BATTERY B	STATE	RED	GREEN	BATT TEMP	BATT TEMP	

TABLE 3.5. TITAN IV-B RSTS LATCHING - CONTINUED

MEASUREMENT ID	MEASUREMENT DESCRIPTION	Data Type	Display Color		Display Text		Latching State
			OFF	ON	OFF	ON	
TD101	STG1 FTC1 HOT LINE	STATE	RED	GREEN	HOT LINE	HOT LINE	
TD102	STG1 FTC2 HOT LINE	STATE	RED	GREEN	HOT LINE	HOT LINE	
TD103 ¹	STG1 SAFE/ARM1 SAFE	STATE	GRAY	RED	S/A ARM	S/A SAFE	
TD104 ¹	STG1 SAFE/ARM1 ARM	STATE	RED	GREEN	S/A SAFE	S/A ARM	
TD105 ¹	STG1 SAFE/ARM2 SAFE	STATE	GRAY	RED	S/A ARM	S/A SAFE	
TD106 ¹	STG1 SAFE/ARM2 ARM	STATE	RED	GREEN	S/A SAFE	S/A ARM	
TD214	STG2 FTC1 HOT LINE	STATE	RED	GREEN	HOT LINE	HOT LINE	
TD215	STG2 FTC2 HOT LINE	STATE	RED	GREEN	HOT LINE	HOT LINE	
TD216 ¹	STG2 SAFE/ARM1 SAFE	STATE	GRAY	RED	S/A ARM	S/A SAFE	
TD217 ¹	STG2 SAFE/ARM1 ARM	STATE	RED	GREEN	S/A SAFE	S/A ARM	
TD218 ¹	STG2 SAFE/ARM2 SAFE	STATE	GRAY	RED	S/A ARM	S/A SAFE	
TD219 ¹	STG2 SAFE/ARM2 ARM	STATE	RED	GREEN	S/A SAFE	S/A ARM	
TDT10	STG2 CRD 1 MON	STATE	RED	GREEN	PILOT	PILOT	
TDT12	STG2 CRD 2 MON	STATE	RED	GREEN	PILOT	PILOT	

¹NOTE: TO SET AN ARM CONDITION THE SAFE MEASUREMENT (TD103, TD105, TD216, AND TD218) MUST BE A “ZERO” AND THE ARM MEASUREMENT (TD104, TD106, TD217, AND TD219) MUST BE A “ONE”. TO SET A SAFE CONDITION THE SAFE MEASUREMENT (TD103, TD105, TD216, AND TD218) MUST BE A “ONE” AND THE ARM MEASUREMENT (TD104, TD106, TD217, AND TD219) MUST BE A “ZERO”.

TABLE 3.6. TITAN IV-B RSTS GREEN BOARD MEASUREMENT LIST

CRD A	SRMU1A	SRMU1B	SRMU2A	SRMU2B	FRAME SYNC	CRD B	STAGE 1A	STAGE 1B	STAGE 2A	STAGE 2B
TET02	TDAF3	TDAF4	TDBF3	TDBF4		TET06	TE111	TE122	TE251	TE261
TET08	TEA30	TEA31	TEB30	TEB31		TET09	TD103	TD105	TD216	TD218
TDT10	TDAF1	TDAF2	TDBF1	TDBF2	(RESET)	TDT12	TD104	TD106	TD217	TD219
TE225	TDAF7	TDAF8	TDBF7	TDBF8		TE226	TD101	TD102	TD214	TD215
TC225	TDAF5	TDAF6	TDBF5	TDBF6		TC226	TE114	TE115	TE254	TE255
TE203	TEAB1	TEAB2	TEBB1	TEBB2		TE205	TE112	TE113	TE252	TE253
TT230	TTA25	TTA26	TTB25	TTB26		TT232	TE135	TE137	TE235	TE237
							TT102	TT104	TT204	TT208

NOTE: Measurements are logically “anded.” All measurements must be within tolerance or in a state that signifies a green condition.

TABLE 8.1. TITAN IV-B ATMOSPHERIC DATA REQUIREMENTS

Assessment	Atmospheric Parameters	Development Time by 30 WS	Data Sent to FSA	FSA Analysis Complete	Requirement
1. L-1 day debris risk	T-0 forecast of wind speed and direction, 0-60,000 ft	8-5 hr prior to LRR	5 hr prior to LRR	2 hr prior to LRR	R
2. L-1 day toxic risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-10,000 ft	6-3 hr prior to LRR	3 hr prior to LRR	2 hr prior to LRR	R
3. L-1 day overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	6-3 hr prior to LRR	3 hr prior to LRR	2 hr prior to LRR	R
4. RSDS display	Observed wind speed and direction, 0-60,000 ft (met input sent to ROMSSC)	T-8 to T-4:45 hr	Update complete by T-3 hr		R
5. Pre-launch debris risk	Observed wind speed and direction, 0-60,000 ft	T-9 to T-7:30 hr (NLT T-8:30 hr) T-8 to T-5 hr (NLT T-6 hr) T-5:10 to T-1:30 hr (NLT T-2:30 hr)	T-7 hr T-4:30 hr T-1 hr	T-5 hr T-3 hr T-30 min	R M M
6. Pre-launch toxic risk	T-0 forecast of wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling and cloud sky coverage for 0-10,000 ft	T-6:30 to T-4:30 hr T-5:30 to T-3:30 hr T-4:30 to T-2:30 hr T-3:30 to T-1:30 hr (all valid T-0 to T+1 hr)	T-4:30 hr T-3:30 hr T-2:30 hr T-1:30 hr	T-3:45 hr T-2:45 hr T-1:45 hr T-:45 min	R R R M
7. Pre-launch overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	T-6:30 to T-4:30 hr T-5:30 to T-3:30 hr T-4:30 to T-2:30 hr T-3:30 to T-1:30 hr (all valid T-0 to T+1 hr)	T-4:30 hr T-3:30 hr T-2:30 hr T-1:30 hr	T-3:45 hr T-2:45 hr T-1:45 hr T-:45 min	R R R M
8. Liftoff toxic hazard	Same as box 6	<u>Developed</u> T-1:30 hr to T-10 min	<u>Valid</u> T-0 to T+10 min	<u>To FSA</u> T-10 min	T-2 mins R
9. Launch delay toxic risk	Same as box 6; valid for 60 min intervals	<u>Developed</u> T-1:30 hr to T-0 T+30 min to T+1:30 hr T+1:00 to T+2:30 hr ... T+3:30 to T+4:30 hr	<u>Valid</u> T+1 to T+2 hr T+2 to T+3 hr T+3 to T+4hr ... T+5 to T+6 hr	<u>To FSA</u> T+30 min T+1:30 hr T+2:30 hr ... T+5:30 hr	30 min after receipt of data M
10. Cat abort toxic hazard	Same as box 6; valid for 15 min intervals	<u>Developed</u> T-0 to T+10 min T+15 to T+30 min	<u>Valid</u> T+15 min to T+30 min T+30 min to T+45 min	<u>To FSA</u> T+15 min T+30 min	ASAP after Cat Abort M
11. Re-constructed T-0 weather profile for toxic & overpressure analyses	Observed wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling, cloud sky coverage and turbulence measurements for 0-20,000 ft	T-0 to T+24 hr	T+24 hr	N/A	R

PEGASUS

1.0. General. This annex specifies flight control support requirements for Pegasus missions. The SMFCO may approve changes to this annex to accommodate operation-peculiar requirements.

2.0. Range Tracking Systems (RTS). Two adequate and independent instrumentation data sources from liftoff through flight control end of mission are MANDATORY.

2.1. Radar. Radars supporting a MANDATORY requirement must be capable of tracking in both skin and transponder modes. A radar slaving source is REQUIRED.

2.1.1. Local. One Vandenberg AFB radar with RF visibility to the drop site and ability to provide quality on-target track of either the booster or transponder no later than three (3) seconds prior to minimum time to endanger (MTE-3 sec) is MANDATORY for drop. Data from drop is REQUIRED. A second Vandenberg AFB radar is REQUIRED for drop.

2.1.2. Remote. Not required.

2.1.3. TNAR Filter. Not required.

2.2. Transponder. A trackable non-coherent C-band transponder on the launch vehicle is MANDATORY.

2.3. Telemetered Inertial Guidance (TMIG). One string of TMIG is MANDATORY and a second string is REQUIRED.

2.4. Global Positioning System (GPS). The use of a GPS translator or receiver shall be considered on a case-by-case basis until adequate experience has been gained to define these requirements. If flown, one string of GPS present position and IIP data is REQUIRED.

3.0. Telemetry. Receipt of telemetered data from the first FTS turn-on through flight control EOM is MANDATORY. One Vandenberg AFB TM site is MANDATORY. A telemetry slaving source is REQUIRED.

4.0. Command. The capture of the CRDs from turn on through flight control EOM is MANDATORY.

4.1. Command systems. A centrally controlled command processing system is MANDATORY. Configure CCS modes as follows:

CCS Mode	Configuration
Operational	Single Non-Redundant
Support	Standard
Failure	Dual

4.2. Command transmitters. Two Vandenberg AFB command transmitters with directional and omni-directional antennas and RF visibility to the drop site are MANDATORY. Remote transmitters are not required. Power must be supplied to the MANDATORY command transmitters in such a way so that the loss of a single source of power will not disable both transmitters. Elevation of the directional antennas will not be less than three degrees unless directed by the MFCO. Carrier frequency is 416.5 MHz with +/- 30 kHz deviation per tone, Expanded Mode, Monitor 4. Initiate local omni to directional antenna switch at MFCO direction.

4.3. Command slaving source. A real-time slaving source is MANDATORY for the directional antenna at each command transmitter site prime for supporting a MANDATORY command transmitter requirement.

4.4. Command failover. Automatic failover capability connecting all supporting command transmitters is MANDATORY.

4.5. Flight termination system (FTS). A redundant launch vehicle FTS is MANDATORY.

5.0. Displays. The continuous real-time display of launch vehicle performance and system status that affects flight safety is MANDATORY.

5.1. Tracking Display. Two complete Range Safety Display Systems (RSDS) are MANDATORY. Each string will consist of one MANDATORY and one REQUIRED display for the MFCO and one MANDATORY and one REQUIRED display for the RTDC. Display markers for support aircraft, seacraft, oil platforms and unsheltered launch area personnel are REQUIRED. A mission continuation display is REQUIRED.

5.2. MFCO Stripchart Display. Two stripchart recorders are REQUIRED. MFCC stripchart recorder console lights are REQUIRED. Configure the red and green lights above each MFCC stripchart recorder such that the green lights are illuminated when the telemetry bit stream is in sync and the red lights are illuminated when the bit stream is out of sync. MFCC stripchart recorders should be configured for best source display. Configure each stripchart recorder channel for full-scale data display.

5.2.1. Chamber Pressure. Booster chamber pressure telemetry for each engine is REQUIRED. Chamber pressure channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.2. Steering. Vehicle steering (yaw, pitch, roll) is REQUIRED. Steering channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.3. Automatic Gain Control (AGC). Command Receiver Decoder (CRD) AGC levels are REQUIRED. AGC assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

Table 5.1. MFCC Stripchart Recorder Channel Assignments.

Recorder #1

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/1	Yaw Rate	R
2/2	Pitch Rate	R
3/3	Roll Rate	R
4/4	Stage 1 Chamber Pressure	R
5/5	Stage 2 Chamber Pressure	R
6/6	Stage 3 Chamber Pressure	R
7/7	AGC Command Receiver 1	R
8/8	AGC command receiver 2	R
EVENT/9	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

Recorder #2

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/10	Yaw Rate	R
2/11	Pitch Rate	R
3/12	Roll Rate	R
4/13	Stage 1 Chamber Pressure	R
5/14	Stage 2 Chamber Pressure	R
6/15	Stage 3 Chamber Pressure	R
7/16	AGC Command Receiver 1	R
8/17	AGC command receiver 2	R
EVENT/18	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

5.3. FSPO Display. A real-time Range Safety telemetry display for the FSPO, capable of providing data until flight control EOM, is MANDATORY. FSPO display requirements are specified in Table 5.2, FSPO Display Locations & Requirements. RSTS FSPO console data display requirements are specified in Tables 3.3 through 3.6 at the end of this annex. A redundant RSTS console is DESIRED.

Table 5.2. FSPO Display Locations & Requirements.

Blockhouse		RSTS Display		RSTS Stripchart		QLDA-7 W/S	
T-0	Flight	T-0	Flight	T-0	Flight	T-0	Flight
R	R	R	R	M	M	D	D

5.4. Command Status Display. A MFCO status panel is MANDATORY for each active centrally controlled command processing system.

5.5. Attitude Display. Not required.

5.6. Mission Discrete Indicators (MDIs). MDIs are REQUIRED. MDI assignments are specified in Table 5.3, Mission Discrete Indicator Assignments.

Table 5.3. Mission Discrete Indicator Assignments.

<u>Parameter</u>	<u>Display</u>	<u>Display Color</u>	<u>Requirement</u>
TM Synchronization	SYNC	Red	R
Booster Separated	BSEP	Green	R
Command Receiver 1 Armed	1ARM	Red	R
Command Receiver 2 Fired	1DST	Red	R
Command Receiver 1 Armed	2ARM	Red	R
Command Receiver 2 Fired	2DST	Red	R
Tone 4 Monitor, Receiver 1	TONE1	Red	R
Tone 4 Monitor, Receiver 2	TONE2	Red	R

6.0. Communications.

6.1. Voice Communications. MFCO voice communications are restricted from monitor access by agencies outside 30 SW/SE without written permission.

6.1.1. MFCO Voice Circuits. The MANDATORY and REQUIRED voice networks (nets) and voice direct lines (VDL) listed in Table 6.1, MFCO Voice Circuit Requirements, describe the voice circuit requirements at the MFCO-1 and MFCO-2 consoles. Access by all positions on the MFCO Safety Net is MANDATORY and each position will have talk and continuous monitor capability. Table 6.2, RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements, describes the voice circuit requirements at the RSTS-1 and RSTS-2 consoles.

Table 6.1. MFCO Voice Circuit Requirements

Comm Circuit	Requirement	Comm Circuit	Requirement
MFCO Safety Net	M	TMO*	R
Countdown Net	M	FSPO*	R
CCT-1 Net	M	RSTS FSPO*	R
Safety Engineering Net	R	ROC	R
Range Safety Net	R	RCO	R
CCT-2 Net	R	ACO*	R
Emergency Net	R	LWO	R
SCMDR Conf Net	R	DCO	R
Safety Radio Net	R	MCS/MC	R

Weather Conf Net	R	SCMDR	R
Ground Ops	R	OD	R
Anomaly	R	SE	R
MFCO-1 (at MFCO-2)*	R	Command Post	R
MFCO-2 (at MFCO-1)*	R	T&FS	R
CMD-1*	R	MD	R
CMD-2*	R	LC/LCA	R
RTDC-1*	R	Class A Line	R
RTDC-2*	R		

* - Indicates positions with full MFCO Safety Net access.

Table 6.2. RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements

Comm Circuit	RSTS FSPO	RSTS QLDA-7
MFCO Safety Net	M	D (Monitor)
Countdown Net	M	D
Safety Engineering Net	R	-
CCT-1 Net	R	-
CCT-2 Net	R	-
Weather Conf Net	R	-
S/MFCO	R	-
FSPO	R	D
RSTS FSPO	-	D
RCO	R	-
SE	R	-
Class A Line	R	D

6.1.2. Provide two REQUIRED Class A telephone lines and one telephone for the Flight Safety Analyst workstation in the MFCC. A Class A telephone line between the MFCC Toxic Analyst workstation and DC-90 is not required. Access to a secure telephone in the MFCC is REQUIRED.

6.1.3. LST Communications. Not required.

6.1.4. ISB Communications. Range Safety Net and Countdown Net monitors are REQUIRED. A Class A administrative telephone is REQUIRED. Range countdown clock is REQUIRED. CCTV capability is REQUIRED.

6.2. Status/Alert (S&A) System. Status/Alert modules are REQUIRED at each MFCO console from the following positions: ACO, CMD-1, CMD-2, RTDC-1, RTDC-2, FSPO and RSTS FSPO.

6.3. Closed Circuit Television (CCTV). The following five (simultaneous) displays are REQUIRED on each MFCO console: Program TV, Back Az TV, ADS, chase aircraft (if available)

and on-board L-1011. Best source video is REQUIRED at the ISB post.

6.4. Optics. One long-range optic source is REQUIRED. Two launch area video cameras, identified as Program and Back Az, are REQUIRED in the flight line area when L-1011 takeoff occurs at Vandenberg AFB. Chase aircraft, if available, is REQUIRED.

6.5. Missile Lift-off Signal. A positive lift-off indication is REQUIRED.

6.6. Command Communications. The data transmission link between each CCT and the central command system will consist of two MANDATORY and two REQUIRED complete and independent duplex command and status circuits as well as one MANDATORY and one REQUIRED complete and independent duplex pointing data circuits.

6.7. Range Communication.

6.7.1. N/A

6.7.2. The ability to “breakaway” from a launch vehicle anomaly when directed for all supporting aircraft whose Test Support Point (TSP) lies within the ILL is MANDATORY. The ability to receive this communication is REQUIRED. If this communication capability is lost, “no-radio” (NORDO) procedures will be implemented, which shall include a return to base procedure to avoid closed airspace (impact boxes and up range hazard and caution areas).

6.8. Clocks. Visibility by all console positions within the Mission Flight Control Center (MFCC) to UTC, range countdown and pad clocks is REQUIRED.

7.0. Data Processing. The systems that process metric and telemetry data for output to MFCC displays are at the same level of decision authority as are required for the data to be displayed. Processing and transfer of weather data to MFCC systems are required at the levels of decision authority as specified in Appendix D, Pegasus Weather System and Instrumentation Support Plan.

8.0. Meteorological. Receipt of weather data is not required.

8.1. Local Atmospheric Data. See Table 8.1, Pegasus Atmospheric Data Requirements.

8.2. Launch Commit Criteria. The Weather Aircraft is REQUIRED. Launch will not occur if weather conditions violate MANDATORY safety constraints for natural and triggered lightning, or triboelectrification, as described in Appendix C, Range Safety Weather Launch Commit Criteria.

8.3. Post Operation. See Table 8.1, Pegasus Atmospheric Data Requirements.

9.0. Area Clearance. Clearance of all non-mission essential personnel from areas under 30 SW surveillance and control is MANDATORY.

9.1. On-shore Surface. Not required.

9.2. Offshore Surface. Clearance of danger zones and hazard areas, including uprange impact areas, is MANDATORY.

9.3. Airspace. Clearance of non-mission essential aircraft from launch safety airspace is MANDATORY.

9.4. Surveillance. A surveillance helicopter is not required. The UPRR Trainmaster is not required. NAWC boat support is not required.

9.5. Recovery. Not required.

10.0. Data Requirements. All items are REQUIRED. See Table 10.1, Data Requirements.

Table 10.1. Data Requirements.

Data Item	Title	Data	Deliver
380.00	Post Launch Analysis Of Radar Systems, Letter Report	PLARS Report	17 WD
401.00	Video Cassette Recording	Format: SVHS (DVD is DESIRED) Time: T-90 seconds - LOV Video: Composite of Program, Back Az, LA-24, Santa Ynez, Vehicle on-board, Carrier Aircraft, Chase aircraft Audio: Ch 1 MFCO Safety Net; Ch 2 IRIG-B	3 WD
416.00	Single Channel Voice Recording	Voice-operated MFCO communications (Compact Disc)	On Request
927.00	Events Display Recording – Range Safety	MFCC MFCO Stripchart Recorders 1 & 2	30 Minutes
928.00	Events Display Recording – Flight Safety	MFCC RSTS Stripchart Recorders 1 & 2	30 Minutes

TABLE 3.2. PEGASUS RSTS FSPO STRIPCHART SETUP SHEET

FSPO-1FSPO-2

Channel No.	Description	Type	Range Low	Range High	Channel No.	Description	Type	Range Low	Range High
1	SYNC	S	0 OFF	1 ON	1	SYNC	S	0 OFF	1 ON
2	S38	A	0 Volts	5 Volts	2	S38	A	0 Volts	5 Volts
3	S41	D	0	1	3	S41	D	0	1
4	S39	D	0	1	4	S39	D	0	1
5	S40	D	0	1	5	S40	D	0	1
6	S42	A	0 Volts	5 Volts	6	S42	A	0 Volts	5 Volts
7	S45	D	0	1	7	S45	D	0	1
8	S43	D	0	1	8	S43	D	0	1
9	S44	D	0	1	9	S44	D	0	1
10					10				
11					11				
12					12				
13					13				
14					14				
15					15				
16					16				
17					17				
18					18				
19					19				
20					20				
21					21				
22					22				
23					23				
24					24				
25					25				
26					26				
27					27				
28					28				
29					29				
30					30				
31					31				
32	TIMING	IRIG A			32	TIMING	IRIG A		

TABLE 3.3. PEGASUS RSTS DISPLAY EXAMPLE

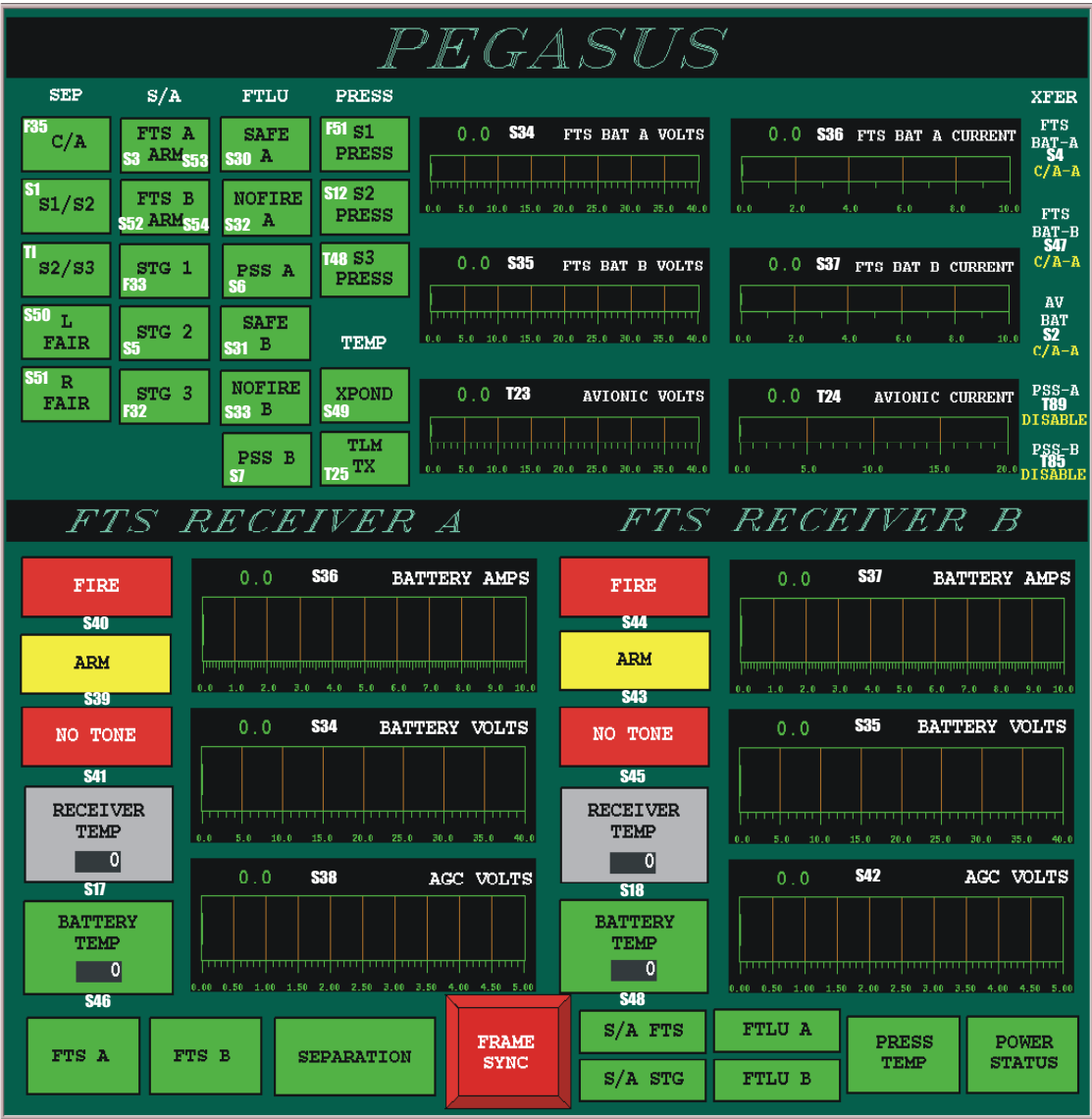


TABLE 3.4. PEGASUS RSTS LIMITS

MEASUREMENT ID	MEASUREMENT DESCRIPTION	Data Type	Resolution	Units	Display Range		Limit Checking				Latching State
							YELLOW		RED		
S49	C-BAND TEMP	FLOAT	3.1	DEG/C	-77.4	182.5	< 15.0	> 35.0		> 37.0	
T25	TLM XMITTER TEMP	FLOAT	3.1	DEG/C	-78.3	181.5	< 15.0	> 30.0		> 43.0	
S34	FTS A BUS VOLTAGE	FLOAT	3.1	VOLTS	0.0	40.0		> 29.5	< 28.0	> 34.0	
S35	FTS A BUS VOLTAGE	FLOAT	3.1	VOLTS	0.0	40.0		> 29.5	< 28.0	> 34.0	
T23	AVIONICS BUS VOLT	FLOAT	3.1	VOLTS	0.0	40.0		> 29.0	< 27.0	> 32.5	
S36	FTS A BUS CURRENT	FLOAT	3.1	AMPS	0.0	10.3		> 0.2	< 0.1	> 0.4	
S37	FTS B BUS CURRENT	FLOAT	3.1	AMPS	0.0	10.3		> 0.2	< 0.1	> 0.4	
T24	AVIONICS BUS AMPS	FLOAT	3.1	AMPS	0.0	20.0			< 7.5	> 10.0	
S17	FTS A RCVR TEMP	FLOAT	3.1	DEG/C	-80.2	179.7	< 23.0		< 9.0	> 43.0	
S18	FTS B RCVR TEMP	FLOAT	3.1	DEG/C	-80.2	179.7	< 23.0		< 9.0	> 43.0	
S46	FTS A BATT TEMP	FLOAT	3.1	DEG/C	-77.4	182.5	< 13.0	> 22.0	< 5.0	>37.0	
S48	FTS B BATT TEMP	FLOAT	3.1	DEG/C	-77.4	182.5	< 13.0	> 22.0	< 5.0	>37.0	
S38	FTS A SIG STRENGTH	FLOAT	3.1	VOLTS	0.0	5.0	< 2.5	>4.0	< 3.5		
S42	FTS B SIG STRENGTH	FLOAT	3.1	VOLTS	0.0	5.0	< 2.5	> 4.0	< 3.5		

TABLE 3.5. PEGASUS RSTS LATCHING

MEASUREMENT ID	MEASUREMENT DESCRIPTION	Data Type	Display Color		Display Text		Latching State
			OFF	ON	OFF	ON	
F35	C/A SEPARATION	STATE	RED	GREEN	C/A	C/A	
S1	S1/S2 SEPARATION	STATE	RED	GREEN	S1/S2	S1/S2	
T1	S2/S3 SEPARATION	STATE	RED	GREEN	S2/S3	S2/S3	
S50	LEFT FARING SEP	STATE	RED	GREEN	L FAIR	L FAIR	
S51	RIGHT FARING SEP	STATE	RED	GREEN	R FAIR	R FAIR	
S3	FTS A SAFE/ARM SAFE	STATE	GREEN	AMBER	FTS A ARM	FTS A SAFE	
S52	FTS B SAFE/ARM SAFE	STATE	GREEN	AMBER	FTS B ARM	FTS B SAFE	
S53	FTS A SAFE/ARM ARM	STATE	GREEN	AMBER	FTS A ARM	FTS A SAFE	
S54	FTS B SAFE/ARM ARM	STATE	GREEN	AMBER	FTS B ARM	FTS B SAFE	
F33	S1 SEP SAFE/ARM	STATE	AMBER	GREEN	STG 1 ARM	STG 1 SAFE	
S5	S2 SEP SAFE/ARM	STATE	AMBER	GREEN	STG 2 ARM	STG 2 SAFE	
F32	MOTOR SAFE/ARM	STATE	AMBER	GREEN	STG 3 ARM	STG 3 SAFE	
S30	FTLU A ARM	STATE	GRAY	RED	SAFE	ARM	
S32	FTLU A FIRE	STATE	GRAY	RED	NO FIRE	FIRE	
S6	FTLU A PSS ENABLE	STATE	GREEN	AMBER	ENABLE	DISABLE	
S31	FTLU B ARM	STATE	GRAY	RED	SAFE	ARM	
S33	FTLU B FIRE	STATE	GRAY	RED	NO FIRE	FIRE	
S7	FTLU B PSS ENABLE	STATE	GREEN	AMBER	ENABLE	DISABLE	
S4	FTS BAT A PWR XFER	STATE	RED	GREEN	C/A	PEG	
S47	FTS BAT B PWR XFER	STATE	RED	GREEN	C/A	PRG	
T2	AVIONICS STATE PTS	STATE	RED	GREEN	C/A	PEG	
T89	PSS DISABLE A	STATE	GREEN	AMBER	ENABLE	DISABLE	
T85	PSS DISABLE B	STATE	GREEN	AMBER	ENABLE	DISABLE	
S40	FTLU A FIRE STATUS	STATE	GRAY	RED	NO FIRE	FIRE	
S44	FTLU B FIRE STATUS	STATE	GRAY	RED	NO FIRE	FIRE	
S39	FTS A ARM MON	STATE	GRAY	GREEN	ARM	SAFE	
S41	FTS A RCVR CHN MON	STATE	RED	GREEN	NO TONE	TONE	
S43	FTS B ARM NON	STATE	GRAY	GREEN	ARM	SAFE	
S45	FTS B RCVR CHN MON	STATE	RED	GREEN	NO TONE	TONE	

TABLE 3.6. PEGASUS RSTS GREEN BOARD MEASUREMENT LIST

FTS A	S/A FTS A	SEPARATION	FTLU A	FRAME SYNC	FTS B	TEMP PRESSURE	POWER STATUS
S34	S3	F35	S30		S44	F51	T23
S39	S53	S2	S6	(RESET)	S43	S12	T24
S41		S1	S32		S45	T48	S34
S17	S/A FTS B	T1	FTLU B		S18	S49	S35
S46		S50			S48	T25	S36
S36		S51			S37		S37
S34	S52		S31		S35		T85
S38	S54		S7		S42		
			S33				

TABLE 8.1. PEGASUS ATMOSPHERIC DATA REQUIREMENTS

Assessment	Atmospheric Parameters	Development Time by 30 WS	Data Sent to FSA	FSA Analysis Complete	Requirement	
1. L-1 day debris risk	T-0 forecast of wind speed and direction, 0-60,000 ft	N/A	N/A	N/A	NR	
2. L-1 day toxic risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-10,000 ft	N/A	N/A	N/A	NR	
3. L-1 day overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A	N/A	N/A	NR	
4. RSDS display	Observed wind speed and direction, 0-60,000 ft (met input sent to ROMSSC)	N/A	N/A		NR	
5. Pre-launch debris risk	Observed wind speed and direction, 0-60,000 ft	N/A	N/A	N/A	NR	
6. Pre-launch toxic risk	T-0 forecast of wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling and cloud sky coverage for 0-10,000 ft	N/A	N/A	N/A	NR	
7. Pre-launch overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A	N/A	N/A	NR	
8. Liftoff toxic hazard	Same as box 6	<u>Developed</u> N/A	<u>Valid</u> N/A	<u>To FSA</u> N/A	N/A	NR
9. Launch delay toxic risk	Same as box 6; valid for 60 min intervals	<u>Developed</u> N/A	<u>Valid</u> N/A	<u>To FSA</u> N/A	N/A	NR
10. Cat abort toxic hazard	Same as box 6; valid for 15 min intervals	<u>Developed</u> N/A	<u>Valid</u> N/A	<u>To FSA</u> N/A	N/A	NR
11. Re-constructed T-0 weather profile for toxic & overpressure analysis	Observed wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling, cloud sky coverage and turbulence measurements for 0-10,000 ft	N/A	N/A	N/A	NR	

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TAURUS

1.0. General. This annex specifies flight control support requirements for Taurus missions. The SMFCO may approve changes to this annex to accommodate operation-peculiar requirements.

2.0. Range Tracking Systems (RTS). Two adequate and independent instrumentation data sources from liftoff through flight control end of mission are MANDATORY.

2.1. Radar. Radars supporting a MANDATORY requirement must be capable of tracking in both skin and transponder modes. A radar slaving source is REQUIRED.

2.1.1. Local. One Vandenberg AFB radar with RF visibility to the launch site and ability to provide quality on-target track of either the booster or transponder no later than three (3) seconds prior to minimum time to endanger (MTE-3 sec) is MANDATORY for liftoff. Data from liftoff is REQUIRED. A second Vandenberg AFB radar is REQUIRED for liftoff.

2.1.2. Remote. One remote radar (downrange and/or crossrange from Vandenberg AFB) is MANDATORY for liftoff.

2.1.3. TNAR Filter. Not required.

2.2. Transponder. A trackable non-coherent C-band transponder on the launch vehicle is MANDATORY.

2.3. Telemetered Inertial Guidance (TMIG). One string of TMIG is MANDATORY and a second string is REQUIRED.

2.4. Global Positioning System (GPS). The use of a GPS translator or receiver shall be considered on a case-by-case basis until adequate experience has been gained to define these requirements. If flown, one string of GPS present position and IIP data is REQUIRED.

3.0. Telemetry. Receipt of telemetered data from the first FTS turn-on through flight control EOM is MANDATORY. One Vandenberg AFB TM site is MANDATORY and one TM site is MANDATORY. A telemetry slaving source is REQUIRED.

4.0. Command. The capture of the CRDs from turn on through flight control EOM is MANDATORY.

4.1. Command systems. A centrally controlled command processing system is MANDATORY. Configure CCS modes as follows:

CCS Mode	Configuration
Operational	Single Non-Redundant
Support	Standard
Failure	Dual

4.2. Command transmitters. Two Vandenberg AFB command transmitters with directional and omni-directional antennas and RF visibility to the launch site are MANDATORY. The primary transmitter system must have line-of-site to the pad. Two remote transmitters (downrange and/or crossrange from Vandenberg AFB) with directional antennas are MANDATORY. Power must be supplied to the MANDATORY command transmitters in such a way so that the loss of a single source of power will not disable both transmitters. Elevation of the directional antennas will not be less than three degrees unless directed by the MFCO. Carrier frequency is 416.5 MHz with +/- 30 kHz deviation per tone, Expanded Mode, Monitor 4. Initiate prime CCT switches from local to remote transmitter at T+55 sec. Initiate local omni to directional antenna switch at T+60 seconds.

4.3. Command slaving source. A real-time slaving source is MANDATORY for the directional antenna at each command transmitter site prime for supporting a MANDATORY command transmitter requirement.

4.4. Command failover. Automatic failover capability connecting all supporting command transmitters is MANDATORY.

4.5. Flight termination system (FTS). A redundant launch vehicle FTS is MANDATORY.

5.0. Displays. The continuous real-time display of launch vehicle performance and system status that affects flight safety is MANDATORY.

5.1. Tracking Display. Two complete Range Safety Display Systems (RSDS) are MANDATORY. Each string will consist of one MANDATORY and one REQUIRED display for the MFCO and one MANDATORY and one REQUIRED display for the RTDC. Display markers for support aircraft, seacraft, oil platforms and unsheltered launch area personnel are REQUIRED. A mission continuation display is REQUIRED.

5.2. MFCO Stripchart Display. Two stripchart recorders are REQUIRED. MFCC stripchart recorder console lights are REQUIRED. Configure the red and green lights above each MFCC stripchart recorder such that the green lights are illuminated when the telemetry bit stream is in sync and the red lights are illuminated when the bit stream is out of sync. MFCC stripchart recorders should be configured for best source display. Configure each stripchart recorder channel for full-scale data display.

5.2.1. Chamber Pressure. Booster chamber pressure telemetry for each engine is REQUIRED. Chamber pressure channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.2. Steering. Vehicle steering (yaw, pitch, roll) is REQUIRED. Steering channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.3. Automatic Gain Control (AGC). Command Receiver Decoder (CRD) AGC levels are REQUIRED. AGC assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

Table 5.1. MFCC Stripchart Recorder Channel Assignments.

Recorder #1

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/1	Yaw Rate	R
2/2	Pitch Rate	R
3/3	Roll Rate	R
4/4	Stage 0 Chamber Pressure	R
5/5	Stage 1 Chamber Pressure	R
6/6	Stage 2 Chamber Pressure	R
7/7	AGC Command Receiver 1	R
8/8	AGC Command Receiver 2	R
EVENT/9	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

Recorder #2

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/10	Yaw Rate	R
2/11	Pitch Rate	R
3/12	Roll Rate	R
4/13	Stage 0 Chamber Pressure	R
5/14	Stage 1 Chamber Pressure	R
6/15	Stage 2 Chamber Pressure	R
7/16	AGC Command Receiver 1	R
8/17	AGC Command Receiver 2	R
EVENT/18	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

5.3. FSPO Display. A real-time Range Safety telemetry display for the FSPO, capable of providing data until flight control EOM, is MANDATORY. FSPO display requirements are specified in Table 5.2, FSPO Display Locations & Requirements. RSTS FSPO console data display requirements are specified in Tables 3.3 through 3.6 at the end of this annex. A redundant RSTS console is DESIRED.

Table 5.2. FSPO Display Locations & Requirements.

Blockhouse		RSTS Display		RSTS Stripchart		QLDA-7 W/S	
T-0	Flight	T-0	Flight	T-0	Flight	T-0	Flight
M	R	R	R	R	M	D	D

5.4. Command Status Display. A MFCO status panel is MANDATORY for each active centrally controlled command processing system.

5.5. Attitude Display. Not required.

5.6. Mission Discrete Indicators (MDIs). MDIs are REQUIRED. MDI assignments are specified in Table 5.3, Mission Discrete Indicator Assignments.

Table 5.3. Mission Discrete Indicator Assignments.

<u>Parameter</u>	<u>Display</u>	<u>Display Color</u>	<u>Requirement</u>
TM Synchronization	SYNC	Red	R
Receiver 1 Armed	1ARM	Red	R
Receiver 1 Fired	1DST	Red	R
Receiver 2 Armed	2ARM	Red	R
Receiver 2 Fired	2DST	Red	R
Tone 4 Monitor, Receiver 1	TONE1	Red	R
Tone 4 Monitor, Receiver 2	TONE2	Red	R

6.0. Communications.

6.1. Voice Communications. MFCO voice communications are restricted from monitor access by agencies outside 30 SW/SE without written permission.

6.1.1. MFCO Voice Circuits. The MANDATORY and REQUIRED voice networks (nets) and voice direct lines (VDL) listed in Table 6.1, MFCO Voice Circuit Requirements, describe the voice circuit requirements at the MFCO-1 and MFCO-2 consoles. Access by all positions on the MFCO Safety Net is MANDATORY and each position will have talk and continuous monitor capability. Table 6.2, RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements, describes the voice circuit requirements at the RSTS-1 and RSTS-2 consoles.

Table 6.1. MFCO Voice Circuit Requirements

Comm Circuit	Requirement	Comm Circuit	Requirement
MFCO Safety Net	M	RSTS FSPO*	R
Countdown Net	M	OSM*	R
CCT-1 Net	M	LST*	R

Safety Engineering Net	R	Program*	R
Range Safety Net	R	Back Az*	R
CCT-2 Net	R	ROC	R
Emergency Net	R	RCO	R
SCMDR Conf Net	R	ACO*	R
Safety Radio Net	R	LWO	R
Weather Conf Net	R	DCO	R
MFCO-1 (at MFCO-2)*	R	MCS/MC	R
MFCO-2 (at MFCO-1)*	R	SCMDR	R
CMD-1*	R	OD	R
CMD-2*	R	SE	R
RTDC-1*	R	Command Post	R
RTDC-2*	R	TC/TCA	R
TMO*	R	Class A Line	R
FSPO*	R		

* - Indicates positions with full MFCO Safety Net access.

Table 6.2. RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements

Comm Circuit	RSTS FSPO	RSTS QLDA-7
MFCO Safety Net	M	D (Monitor)
Countdown Net	M	D
Safety Engineering Net	R	-
CCT-1 Net	R	-
CCT-2 Net	R	-
Weather Conf Net	R	-
S/MFCO	R	-
FSPO	R	D
RSTS FSPO	-	D
RCO	R	-
SE	R	-
Class A Line	R	D

6.1.2. Provide one MANDATORY and two REQUIRED Class A telephone lines and one telephone for the Flight Safety Analyst workstation in the MFCC. A Class A telephone line between the MFCC Toxic Analyst workstation and DC-90 is MANDATORY. Access to a secure telephone in the MFCC is REQUIRED.

6.1.3. LST Communications. The MANDATORY and REQUIRED communication circuits listed in Table 6.3, LST Fallback Communication Access Requirements, will be provided at Building 1762 for all launches utilizing 576E. This communication capability will be available from an

outdoor location at Fallback 4. Additionally, this communication capability will be provided within the support facility.

Table 6.3. LST Fallback Communication Access Requirements.

Comm Circuit	Requirement
MFCO Safety Net (T/M)	M
Countdown Net (M)	R
MFCO VDL	R
OSM VDL	R
ACO VDL	R
DCG VDL (Bldg 11165)	R
Class A Line	R

T = Talk capability

M = Monitor

6.1.4. ISB Communications. Range Safety Net and Countdown Net monitors are REQUIRED. A Class A administrative telephone is REQUIRED. Range countdown clock is REQUIRED. CCTV capability is REQUIRED.

6.2. Status/Alert (S&A) System. Status/Alert modules are REQUIRED at each MFCO console from the following positions: OSM, ACO, CMD-1, CMD-2, RTDC-1, RTDC-2, FSPO and RSTS FSPO.

6.3. Closed Circuit Television (CCTV). The following five (simultaneous) displays are REQUIRED on each MFCO console: Program TV, Back Az TV, Boat Plot, ADS and one long-range optic source. Available long-range optic sources may be split between each MFCO position. Best source video is REQUIRED at the ISB post.

6.4. Optics. One long-range optic source is REQUIRED. Two launch area video cameras, identified as Program and Back Az, are REQUIRED. Television van support locations for Program and Back Az are as follows:

Launch Site	Program Site	Back Az Site
576E	OS 45*	JB 14

* - Indicates visibility to the launch pad

6.5. Missile Lift-off Signal. A positive lift-off indication is REQUIRED.

6.6. Command Communications. The data transmission link between each CCT and the central command system will consist of two MANDATORY and two REQUIRED complete and

independent duplex command and status circuits as well as one MANDATORY and one REQUIRED complete and independent duplex pointing data circuits.

6.7. Range Communication.

6.7.1. All mission essential personnel located inside the Impact Limit Line (ILL) will have means to communicate with their control centers and the LST.

6.7.2. The ability to “breakaway” from a launch vehicle anomaly when directed for all supporting aircraft whose Test Support Point (TSP) lies within the ILL is MANDATORY. The ability to receive this communication is REQUIRED. If this communication capability is lost, “no-radio” (NORDO) procedures will be implemented, which shall include a return to base procedure to avoid closed airspace (impact boxes and up range hazard and caution areas).

6.8. Clocks. Visibility by all console positions within the Mission Flight Control Center (MFCC) to UTC, range countdown and pad clocks is REQUIRED.

7.0. Data Processing. The systems that process metric and telemetry data for output to MFCC displays are at the same level of decision authority as are required for the data to be displayed. Processing and transfer of weather data to MFCC systems are required at the levels of decision authority as specified in Appendix D, Taurus Weather System and Instrumentation Support Plan.

8.0. Meteorological. Receipt of weather data is MANDATORY and/or REQUIRED, as specified in Table 8.1, Taurus Atmospheric Data Requirements.

8.1. Local Atmospheric Data. See Table 8.1, Taurus Atmospheric Data Requirements.

8.2. Launch Commit Criteria. The Weather Aircraft is REQUIRED. Launch will not occur if weather conditions violate MANDATORY safety constraints for natural and triggered lightning, or triboelectrification, as described in Appendix C, Range Safety Weather Launch Commit Criteria.

8.3. Post Operation. See Table 8.1, Taurus Atmospheric Data Requirements.

9.0. Area Clearance. Clearance of all non-mission essential personnel from areas under 30 SW surveillance and control is MANDATORY.

9.1. On-shore Surface. Clearance of all non-mission essential personnel from land areas within the ILL, including the Union Pacific Railroad (UPRR) right-of-way, is MANDATORY. UPRR clearance is as follows (subject to day-of-launch real-time analysis):

Launch Site	Clearance Area
576E	8N-18S

9.2. Offshore Surface. Clearance of danger zones and hazard areas, including uprange impact areas, is MANDATORY.

9.3. Airspace. Clearance of non-mission essential aircraft from launch safety airspace is MANDATORY.

9.4. Surveillance. A surveillance helicopter is REQUIRED. The UPRR Trainmaster is REQUIRED. NAWC boat support is REQUIRED.

9.5. Recovery. Not required.

10.0. Data Requirements. All items are REQUIRED. See Table 10.1, Data Requirements.

Table 10.1. Data Requirements.

Data Item	Title	Data	Deliver
380.00	Post Launch Analysis Of Radar Systems, Letter Report	PLARS Report	17 WD
401.00	Video Cassette Recording	Format: SVHS (DVD is DESIRED) Time: T-90 seconds - LOV Video: Composite of Program, Back Az, LA-24, Santa Ynez, Pad/MST, Vehicle on-board Audio: Ch 1 MFCO Safety Net; Ch 2 IRIG-B	3 WD
416.00	Single Channel Voice Recording	Voice-operated MFCO communications (Compact Disc)	On Request
927.00	Events Display Recording – Range Safety	MFCC MFCO Stripchart Recorders 1 & 2	30 Minutes
928.00	Events Display Recording – Flight Safety	MFCC RSTS Stripchart Recorders 1 & 2	30 Minutes

TABLE 3.2. TAURUS RSTS FSPO STRIPCHART SETUP SHEET

FSPO-1FSPO-2

Channel No.	Description	Type	Range Low	Range High	Channel No.	Description	Type	Range Low	Range High
1	SYNC	S	0 OFF	1 ON	1	SYNC	S	0 OFF	1 ON
2	S38	A	0 Volts	5 Volts	2	S38	A	0 Volts	5 Volts
3	S41	D	0	1	3	S41	D	0	1
4	S39	D	0	1	4	S39	D	0	1
5	S32	D	0	1	5	S32	D	0	1
6	S42	A	0 Volts	5 Volts	6	S42	A	0 Volts	5 Volts
7	S45	D	0	1	7	S45	D	0	1
8	S43	D	0	1	8	S43	D	0	1
9	S33	D	0	1	9	S33	D	0	1
10					10				
11					11				
12					12				
13					13				
14					14				
15					15				
16					16				
17					17				
18					18				
19					19				
20					20				
21					21				
22					22				
23					23				
24					24				
25					25				
26					26				
27					27				
28					28				
29					29				
30					30				
31					31				
32	TIMING	IRIG A			32	TIMING	IRIG A		

TABLE 3.3. TAURUS RSTS DISPLAY EXAMPLE



TABLE 3.4. TAURUS RSTS LIMITS

MEASUREMENT ID	MEASUREMENT DESCRIPTION	Data Type	Resolution	Units	Display Range		Limit Checking				Latching State
							YELLOW		RED		
S46	FTS A BATT TEMP	FLOAT	3.1	DEG/C	-77.4	182.5	< 13.0	> 22.0	< 5.0	>37.0	
S49	FTS B BATT TEMP	FLOAT	3.1	DEG/C	-77.4	182.5	< 13.0	> 22.0	< 5.0	>37.0	
S53	FTS A RCVR TEMP	FLOAT	3.1	DEG/C	-80.2	179.7	< 23.0		< 9.0	> 43.0	
S54	FTS B RCVR TEMP	FLOAT	3.1	DEG/C	-80.2	179.7	< 23.0		< 9.0	> 43.0	
T65	C-BAND TEMP	FLOAT	3.1	DEG/C	-77.4	182.5	< 15.0	> 35.0		> 37.0	
T29	TLM XMITTER TEMP	FLOAT	3.1	DEG/C	-78.3	181.5	< 15.0	> 30.0		> 43.0	
S34	FTS A BUS VOLTAGE	FLOAT	3.1	VOLTS	0.0	40.0		> 29.5	< 28.0	> 34.0	
S35	FTS A BUS VOLTAGE	FLOAT	3.1	VOLTS	0.0	40.0		> 29.5	< 28.0	> 34.0	
T23	AVIONICS BUS VOLT	FLOAT	3.1	VOLTS	0.0	40.0		> 29.0	< 27.0	> 32.5	
S36	FTS A BUS CURRENT	FLOAT	3.1	AMPS	0.0	10.3		> 0.2	< 0.1	> 0.4	
S37	FTS B BUS CURRENT	FLOAT	3.1	AMPS	0.0	10.3		> 0.2	< 0.1	> 0.4	
T24	AVIONICS BUS AMPS	FLOAT	3.1	AMPS	0.0	20.0			< 7.5	> 10.0	
S38	FTS A SIG STRENGTH	FLOAT	3.1	VOLTS	0.0	5.0	< 2.5	>4.0	< 3.5		
S42	FTS B SIG STRENGTH	FLOAT	3.1	VOLTS	0.0	5.0	< 2.5	> 4.0	< 3.5		

TABLE 3.5. TAURUS RSTS LATCHING

MEASUREMENT ID	MEASUREMENT DESCRIPTION	Data Type	Display Color		Display Text		Latching State
			OFF	ON	OFF	ON	
F56	S0/S1 SEPARATION	STATE	RED	GREEN	S0/S1	S0/S1	
S1	S1/S2 SEPARATION	STATE	RED	GREEN	S1/S2	S1/S2	
T95	S2/S3 SEPARATION	STATE	RED	GREEN	S2/S3	S2/S3	
S40	FTS A SAFE/ARM	STATE	GRAY	AMBER	FTS A SAFE	FTS A ARM	
S8	FTS B SAFE/ARM	STATE	GRAY	AMBER	FTS B SAFE	FTS B ARM	
F55	S1 MOTOR SAFE/ARM	STATE	AMBER	GREEN	STG 1 ARM	STG 1 SAFE	
S48	S2 MOTOR SAFE/ARM	STATE	AMBER	GREEN	STG 2 ARM	STG 2 SAFE	
T90	S3 MOTOR SAFE/ARM	STATE	AMBER	GREEN	STG 3 ARM	STG 3 SAFE	
S32	FTLU A FIRE	STATE	GRAY	RED	NO FIRE	FIRE	
S6	FTLU A PSS ENABLE	STATE	GREEN	AMBER	ENABLE	DISABLE	
S33	FTLU B FIRE	STATE	GRAY	RED	NO FIRE	FIRE	
S7	FTLU B PSS ENABLE	STATE	GREEN	AMBER	ENABLE	DISABLE	
S47	FTLU A INTERNAL	STATE	RED	GREEN	INT	EXT	
S44	FTLU B INTERNAL	STATE	RED	GREEN	INT	EXT	
T94	AVIONICS STATE PTS	STATE	RED	GREEN	INT	EXT	
S32	FTLU A FIRE STATUS	STATE	GREEN	RED	NO FIRE	FIRE	
S33	FTLU B FIRE STATUS	STATE	GREEN	RED	NO FIRE	FIRE	
S39	FTS A ARM MON	STATE	GRAY	GREEN	ARM	SAFE	
S41	FTS A RCVR CHN MON	STATE	RED	GREEN	NO TONE	TONE	
S43	FTS B ARM NON	STATE	GRAY	GREEN	ARM	SAFE	
S45	FTS B RCVR CHN MON	STATE	RED	GREEN	NO TONE	TONE	

TABLE 3.6. TAURUS RSTS GREEN BOARD MEASUREMENT LIST

FTS A	S/A FTS A	FTLU A	FRAME SYNC	FTS B	TEMP	POWER STATUS
S32	S40	S32		S33	S46	S44
S41		S6	(RESET)	S45	S49	S47
S36				S37	S53	T94
S34	S/A FTS B	FTLU B		S35	S54	
S38				S42	T65	
S53				S54	T29	
S46	S8	S33		S49		
		S7				

NOTE: Measurements are logically “anded.” All measurements must be within tolerance or in a state that signifies a green condition.

TABLE 8.1. TAURUS ATMOSPHERIC DATA REQUIREMENTS

Assessment	Atmospheric Parameters	Development Time by 30 WS		Data Sent to FSA	FSA Analysis Complete	Requirement
1. L-1 day debris risk	T-0 forecast of wind speed and direction, 0-60,000 ft	8-5 hr prior to LRR		5 hr prior to LRR	2 hr prior to LRR	R
2. L-1 day toxic risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-10,000 ft	N/A		N/A	N/A	NR
3. L-1 day overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A		N/A	N/A	NR
4. RSDS display	Observed wind speed and direction, 0-60,000 ft (met input sent to ROMSSC)	T-8 to T-4:45 hr		Update complete by T-3 hr		R
5. Pre-launch debris risk	Observed wind speed and direction, 0-60,000 ft	T-8 to T-5 hr (NLT T-6 hr) T-4 to T-1:30 hr (NLT T-2:30 hr)		T-4:30 hr T-1 hr	T-3 hr T-30 min	M M
6. Pre-launch toxic risk	T-0 forecast of wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling and cloud sky coverage for 0-10,000 ft	T-4:30 to T-2:30 hr T-3:30 to T-1:30 hr (all valid T-0 to T+1 hr)		T-2:30 hr T-1:30 hr	T-1:45 hr T-:45 min	R M
7. Pre-launch overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A		N/A	N/A	NR
8. Liftoff toxic hazard	Same as box 6	<u>Developed</u> T-1:30 hr to T-10 min	<u>Valid</u> T-0 to T+10 min	<u>To FSA</u> T-10 min	T-2 mins	R
9. Launch delay toxic risk	Same as box 6; valid for 60 min intervals	<u>Developed</u> T-1:30 hr to T-0 T+30 min to T+1:30 hr T+1:00 to T+2:30 hr ... T+3:30 to T+4:30 hr	<u>Valid</u> T+1 to T+2 hr T+2 to T+3 hr T+3 to T+4hr ... T+5 to T+6 hr	<u>To FSA</u> T+30 min T+1:30 hr T+2:30 hr ... T+5:30 hr	30 min after receipt of data	M
10. Cat abort toxic hazard	Same as box 6; valid for 15 min intervals	<u>Developed</u> T-0 to T+10 min T+15 to T+30 min	<u>Valid</u> T+15 min to T+30 min T+30 min to T+45 min	<u>To FSA</u> T+15 min T+30 min	ASAP after Cat Abort	M
11. Re-constructed T-0 weather profile for toxic analysis	Observed wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling, cloud sky coverage and turbulence measurements for 0-10,000 ft	T-0 to T+24 hr		T+24 hr	N/A	R

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ORBITAL SUBORBITAL PROGRAM SPACE LAUNCH VEHICLE

1.0. General. This annex specifies flight control support requirements for OSPSLV (Minotaur) missions. The SMFCO may approve changes to this annex to accommodate operation-peculiar requirements.

2.0. Range Tracking Systems (RTS). Two adequate and independent instrumentation data sources from liftoff through flight control end of mission are MANDATORY.

2.1. Radar. Radars supporting a MANDATORY requirement must be capable of tracking in both skin and transponder modes. A radar slaving source is REQUIRED.

2.1.1. Local. One Vandenberg AFB radar with RF visibility to the launch site and ability to provide quality on-target track of either the booster or transponder no later than three (3) seconds prior to minimum time to endanger (MTE-3 sec) is MANDATORY for liftoff. Data from liftoff is REQUIRED. A second Vandenberg AFB radar is REQUIRED for liftoff.

2.1.2. Remote. One remote radar (downrange and/or crossrange from Vandenberg AFB) is MANDATORY for liftoff.

2.1.3. TNAR Filter. Not required.

2.2. Transponder. A trackable non-coherent C-band transponder on the launch vehicle is MANDATORY.

2.3. Telemetered Inertial Guidance (TMIG). One string of TMIG is MANDATORY and a second string is REQUIRED.

2.4. Global Positioning System (GPS). The use of a GPS translator or receiver shall be considered on a case-by-case basis until adequate experience has been gained to define these requirements. If flown, one string of GPS present position and IIP data is REQUIRED.

3.0. Telemetry. Receipt of telemetered data from the first FTS turn-on through flight control EOM is MANDATORY. One Vandenberg AFB TM site is MANDATORY and one TM site is MANDATORY. A telemetry slaving source is REQUIRED.

4.0. Command. The capture of the CRDs from turn on through flight control EOM is MANDATORY.

4.1. Command systems. A centrally controlled command processing system is MANDATORY. Configure CCS modes as follows:

CCS Mode	Configuration
Operational	Single Non-Redundant
Support	Standard
Failure	Dual

4.2. Command transmitters. Two Vandenberg AFB command transmitters with directional and omni-directional antennas and RF visibility to the launch site are MANDATORY. The primary transmitter system must have line-of-site to the pad. Two remote transmitters (downrange and/or crossrange from Vandenberg AFB) with directional antennas are MANDATORY. Power must be supplied to the MANDATORY command transmitters in such a way so that the loss of a single source of power will not disable both transmitters. Elevation of the directional antennas will not be less than three degrees unless directed by the MFCO. Carrier frequency is 416.5 MHz with +/- 30 kHz deviation per tone, Expanded Mode, Monitor 4. Initiate prime CCT switches from local to remote transmitter at T+35 sec. Initiate local omni to directional antenna switch at T+40 seconds.

4.3. Command slaving source. A real-time slaving source is MANDATORY for the directional antenna at each command transmitter site prime for supporting a MANDATORY command transmitter requirement.

4.4. Command failover. Automatic failover capability connecting all supporting command transmitters is MANDATORY.

4.5. Flight termination system (FTS). A redundant launch vehicle FTS is MANDATORY.

5.0. Displays. The continuous real-time display of launch vehicle performance and system status that affects flight safety is MANDATORY.

5.1. Tracking Display. Two complete Range Safety Display Systems (RSDS) are MANDATORY. Each string will consist of one MANDATORY and one REQUIRED display for the MFCO and one MANDATORY and one REQUIRED display for the RTDC. Display markers for support aircraft, seacraft, oil platforms and unsheltered launch area personnel are REQUIRED. A mission continuation display is REQUIRED.

5.2. MFCO Stripchart Display. Two stripchart recorders are REQUIRED. MFCC stripchart recorder console lights are REQUIRED. Configure the red and green lights above each MFCC stripchart recorder such that the green lights are illuminated when the telemetry bit stream is in sync and the red lights are illuminated when the bit stream is out of sync. MFCC stripchart recorders should be configured for best source display. Configure each stripchart recorder channel for full-scale data display.

5.2.1. Chamber Pressure. Booster chamber pressure telemetry for each engine is REQUIRED. Chamber pressure channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.2. Steering. Vehicle steering (yaw, pitch, roll) is REQUIRED. Steering channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.3. Automatic Gain Control (AGC). Command Receiver Decoder (CRD) AGC levels are REQUIRED. AGC assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

Table 5.1. MFCC Stripchart Recorder Channel Assignments.

Recorder #1

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/1	Yaw	R
2/2	Pitch	R
3/3	Roll	R
4/4	Stage 1 Chamber Pressure	R
5/5	Stage 2 Chamber Pressure	R
6/6	Stage 3 Chamber Pressure	R
7/7	AGC Command Receiver 1	R
8/8	AGC Command Receiver 2	R
EVENT/9	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

Recorder #2

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/10	Yaw	R
2/11	Pitch	R
3/12	Roll	R
4/13	Stage 1 Chamber Pressure	R
5/14	Stage 2 Chamber Pressure	R
6/15	Stage 3 Chamber Pressure	R
7/16	AGC Command Receiver 1	R
8/17	AGC Command Receiver 2	R
EVENT/18	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

5.3. FSPO Display. A real-time Range Safety telemetry display for the FSPO, capable of providing data until flight control EOM, is MANDATORY. FSPO display requirements are specified in Table 5.2, FSPO Display Locations & Requirements. RSTS FSPO console data display requirements are specified in Tables 3.3 through 3.6 at the end of this annex and are TBD. A redundant RSTS console is DESIRED.

Table 5.2. FSPO Display Locations & Requirements.

Blockhouse		RSTS Display		RSTS Stripchart		QLDA-7 W/S	
T-0	Flight	T-0	Flight	T-0	Flight	T-0	Flight
M	R	R	R	R	M	D	D

5.4. Command Status Display. A MFCO status panel is MANDATORY for each active centrally controlled command processing system.

5.5. Attitude Display. Not required.

5.6. Mission Discrete Indicators (MDIs). MDIs are REQUIRED. MDI assignments are specified in Table 5.3, Mission Discrete Indicator Assignments.

Table 5.3. Mission Discrete Indicator Assignments.

<u>Parameter</u>	<u>Display</u>	<u>Display Color</u>	<u>Requirement</u>
TM Synchronization	SYNC	Red	R
Receiver 1 Armed	1ARM	Red	R
Receiver 1 Fired	1DST	Red	R
Receiver 2 Armed	2ARM	Red	R
Receiver 2 Fired	2DST	Red	R
Vehicle Erratic Flight*	VERR	Red	R
Tone 4 Monitor, Receiver 1	TONE1	Red	R
Tone 4 Monitor, Receiver 2	TONE2	Red	R

* - Setup MDI to trigger when all three measurements (yaw AND pitch AND roll) are exceeded. Values for each measurement to be determined by OSC.

6.0. Communications.

6.1. Voice Communications. MFCO voice communications are restricted from monitor access by agencies outside 30 SW/SE without written permission.

6.1.1. MFCO Voice Circuits. The MANDATORY and REQUIRED voice networks (nets) and voice direct lines (VDL) listed in Table 6.1, MFCO Voice Circuit Requirements, describe the voice circuit requirements at the MFCO-1 and MFCO-2 consoles. Access by all positions on the MFCO Safety Net is MANDATORY and each position will have talk and continuous monitor capability. Table 6.2, RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements, describes the voice circuit requirements at the RSTS-1 and RSTS-2 consoles.

Table 6.1. MFCO Voice Circuit Requirements

Comm Circuit	Requirement	Comm Circuit	Requirement
MFCO Safety Net	M	RSTS FSPO*	R
Countdown Net	M	OSM*	R
CCT-1 Net	M	LST*	R
Safety Engineering Net	R	Program*	R
Range Safety Net	R	Back Az*	R
CCT-2 Net	R	ROC	R
Emergency Net	R	RCO	R
SCMDR Conf Net	R	ACO*	R
Safety Radio Net	R	LWO	R
Weather Conf Net	R	DCO	R
MFCO-1 (at MFCO-2)*	R	MCS/MC	R
MFCO-2 (at MFCO-1)*	R	SCMDR	R
CMD-1*	R	OD	R
CMD-2*	R	SE	R
RTDC-1*	R	Command Post	R
RTDC-2*	R	TC/TCA	R
TMO*	R	Class A Line	R
FSPO*	R		

* - Indicates positions with full MFCO Safety Net access.

Table 6.2. RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements

Comm Circuit	RSTS FSPO	RSTS QLDA-7
MFCO Safety Net	M	D (Monitor)
Countdown Net	M	D
Safety Engineering Net	R	-
CCT-1 Net	R	-
CCT-2 Net	R	-
Weather Conf Net	R	-
S/MFCO	R	-
FSPO	R	D
RSTS FSPO	-	D
RCO	R	-
SE	R	-
Class A Line	R	D

6.1.2. Provide one MANDATORY and two REQUIRED Class A telephone lines and one telephone for the Flight Safety Analyst workstation in the MFCC. A Class A telephone line between the

MFCC Toxic Analyst workstation and DC-90 is MANDATORY. Access to a secure telephone in the MFCC is REQUIRED.

6.1.3. LST Communications. The MANDATORY and REQUIRED communication circuits listed in Table 6.3, LST Fallback Communication Access Requirements, will be provided at Building 589 for all launches utilizing SSI CLF and Building 1762 for launches utilizing 576E. This communication capability will be available from an outdoor location at Building 589 and Building 1762. Additionally, this communication capability will be provided within each support facility.

Table 6.3. LST Fallback Communication Access Requirements.

Comm Circuit	Requirement
MFCO Safety Net (T/M)	M
Countdown Net (M)	R
MFCO VDL	R
OSM VDL	R
ACO VDL	R
DCG VDL (Bldg 11165)	R
Class A Line	R

T = Talk capability

M = Monitor

6.1.4. ISB Communications. Range Safety Net and Countdown Net monitors are REQUIRED. A Class A administrative telephone is REQUIRED. Range countdown clock is REQUIRED. CCTV capability is REQUIRED.

6.2. Status/Alert (S&A) System. Status/Alert modules are REQUIRED at each MFCO console from the following positions: OSM, ACO, CMD-1, CMD-2, RTDC-1, RTDC-2, FSPO and RSTS FSPO.

6.3. Closed Circuit Television (CCTV). The following five (simultaneous) displays are REQUIRED on each MFCO console: Program TV, Back Az TV, Boat Plot, ADS and one long-range optic source. Available long-range optic sources may be split between each MFCO position. Best source video is REQUIRED at the ISB post.

6.4. Optics. One long-range optic source is REQUIRED. Two launch area video cameras, identified as Program and Back Az, are REQUIRED. Television van support locations for Program and Back Az are as follows:

Launch Site	Program Site	Back Az Site
SSI CLF	JB 588	≤220° Honda Ridge Road** >220° JB 516
576E	OS 45*	JB 14

* - Indicates visibility to the launch pad

** - No JB exists. Position the van safely on the right shoulder of the road approximately 9/10ths of a mile up Honda Ridge Road (N34° 35' 58.5" W120° 37' 22.5") for optimal viewing of both the launch site and the microwave tower.

6.5. Missile Lift-off Signal. A positive lift-off indication is REQUIRED.

6.6. Command Communications. The data transmission link between each CCT and the central command system will consist of two MANDATORY and two REQUIRED complete and independent duplex command and status circuits as well as one MANDATORY and one REQUIRED complete and independent duplex pointing data circuits.

6.7. Range Communication.

6.7.1. All mission essential personnel located inside the Impact Limit Line (ILL) will have means to communicate with their control centers and the LST.

6.7.2. The ability to "breakaway" from a launch vehicle anomaly when directed for all supporting aircraft whose Test Support Point (TSP) lies within the ILL is MANDATORY. The ability to receive this communication is REQUIRED. If this communication capability is lost, "no-radio" (NORDO) procedures will be implemented, which shall include a return to base procedure to avoid closed airspace (impact boxes and up range hazard and caution areas).

6.8. Clocks. Visibility by all console positions within the Mission Flight Control Center (MFCC) to UTC, range countdown and pad clocks is REQUIRED.

7.0. Data Processing. The systems that process metric and telemetry data for output to MFCC displays are at the same level of decision authority as are required for the data to be displayed. Processing and transfer of weather data to MFCC systems are required at the levels of decision authority as specified in Appendix D, OSPSLV Weather System and Instrumentation Support Plan.

8.0. Meteorological. Receipt of weather data is MANDATORY and/or REQUIRED, as specified in Table 8.1, OSPSLV Atmospheric Data Requirements.

8.1. Local Atmospheric Data. See Table 8.1, OSPSLV Atmospheric Data Requirements.

8.2. Launch Commit Criteria. The Weather Aircraft is REQUIRED. Launch will not occur if weather conditions violate MANDATORY safety constraints for natural and triggered lightning, or triboelectrification, as described in Appendix C, Range Safety Weather Launch Commit Criteria.

8.3. Post Operation. See Table 8.1, OSPSLV Atmospheric Data Requirements.

9.0. Area Clearance. Clearance of all non-mission essential personnel from areas under 30 SW surveillance and control is MANDATORY.

9.1. On-shore Surface. Clearance of all non-mission essential personnel from land areas within the ILL, including the Union Pacific Railroad (UPRR) right-of-way, is MANDATORY. UPRR clearance is as follows (subject to day-of-launch real-time analysis):

Launch Site	Clearance Area
SSI CLF	4S-18S
576E	8N-18S

9.2. Offshore Surface. Clearance of danger zones and hazard areas, including uprange impact areas, is MANDATORY.

9.3. Airspace. Clearance of non-mission essential aircraft from launch safety airspace is MANDATORY.

9.4. Surveillance. A surveillance helicopter is REQUIRED. The UPRR Trainmaster is REQUIRED. NAWC boat support is REQUIRED.

9.5. Recovery. Not required.

10.0. Data Requirements. All items are REQUIRED. See Table 10.1, Data Requirements.

Table 10.1. Data Requirements.

Data Item	Title	Data	Deliver
380.00	Post Launch Analysis Of Radar Systems, Letter Report	PLARS Report	17 WD
401.00	Video Cassette Recording	Format: SVHS (DVD is DESIRED) Time: T-90 seconds - LOV Video: Composite of Program, Back Az, LA-24, Santa Ynez, Pad/MST, Vehicle on-board Audio: Ch 1 MFCO Safety Net; Ch 2 IRIG-B	3 WD
416.00	Single Channel Voice Recording	Voice-operated MFCO communications (Compact Disc)	On Request
927.00	Events Display Recording – Range Safety	MFCC MFCO Stripchart Recorders 1 & 2	30 Minutes
928.00	Events Display Recording – Flight Safety	MFCC RSTS Stripchart Recorders 1 & 2	30 Minutes

TABLE 3.2. OSPSLV RSTS FSPO STRIPCHART SETUP SHEET

FSPO-1FSPO-2

Channel No.	Description	Type	Range Low	Range High	Channel No.	Description	Type	Range Low	Range High
1					1				
2					2				
3					3				
4					4				
5					5				
6					6				
7					7				
8					8	.			
9					9	.			
10					10				
11					11				
12					12				
13					13				
14					14				
15					15				
16					16				
17					17				
18					18				
19					19				
20					20				
21					21				
22					22				
23					23				
24					24				
25					25				
26					26				
27					27				
28					28				
29					29				
30					30				
31					31				
32	TIMING	IRIG B			32	TIMING	IRIG B		

TABLE 3.3. OSPSLV RSTS DISPLAY EXAMPLE

TBD

TABLE 3.4. OSPSLV RSTS LIMITS

[illegible]

TABLE 3.5. OSPSLV RSTS LATCHING[illegible]

TABLE 3.6. OSPSLV RSTS GREEN BOARD MEASUREMENT LIST

[illegible]

TABLE 8.1. OSPSLV ATMOSPHERIC DATA REQUIREMENTS

Assessment	Atmospheric Parameters	Development Time by 30 WS		Data Sent to FSA	FSA Analysis Complete	Requirement
1. L-1 day debris risk	T-0 forecast of wind speed and direction, 0-60,000 ft	8-5 hr prior to LRR		5 hr prior to LRR	2 hr prior to LRR	R
2. L-1 day toxic risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-10,000 ft	N/A		N/A	N/A	NR
3. L-1 day overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A		N/A	N/A	NR
4. RSDS display	Observed wind speed and direction, 0-60,000 ft (met input sent to ROMSSC)	T-8 to T-4:45 hr		Update complete by T-3 hr		R
5. Pre-launch debris risk	Observed wind speed and direction, 0-60,000 ft	T-8 to T-5 hr (NLT T-6 hr) T-4 to T-1:30 hr (NLT T-2:30 hr)		T-4:30 hr T-1 hr	T-3 hr T-30 min	M M
6. Pre-launch toxic risk	T-0 forecast of wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling and cloud sky coverage for 0-10,000 ft	T-4:30 to T-2:30 hr T-3:30 to T-1:30 hr (all valid T-0 to T+1 hr)		T-2:30 hr T-1:30 hr	T-1:45 hr T-:45 min	R M
7. Pre-launch overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A		N/A	N/A	NR
8. Liftoff toxic hazard	Same as box 6	<u>Developed</u> T-1:30 hr to T-10 min	<u>Valid</u> T-0 to T+10 min	<u>To FSA</u> T-10 min	T-2 mins	R
9. Launch delay toxic risk	Same as box 6; valid for 60 min intervals	<u>Developed</u> T-1:30 hr to T-0 T+30 min to T+1:30 hr T+1:00 to T+2:30 hr ... T+3:30 to T+4:30 hr	<u>Valid</u> T+1 to T+2 hr T+2 to T+3 hr T+3 to T+4hr ... T+5 to T+6 hr	<u>To FSA</u> T+30 min T+1:30 hr T+2:30 hr ... T+5:30 hr	30 min after receipt of data	M
10. Cat abort toxic hazard	Same as box 6; valid for 15 min intervals	<u>Developed</u> T-0 to T+10 min T+15 to T+30 min	<u>Valid</u> T+15 min to T+30 min T+30 min to T+45 min	<u>To FSA</u> T+15 min T+30 min	ASAP after Cat Abort	M
11. Re-constructed T-0 weather profile for toxic analysis	Observed wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling, cloud sky coverage and turbulence measurements for 0-10,000 ft	T-0 to T+24 hr		T+24 hr	N/A	R

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DELTA IV

1.0. General. This annex specifies flight control support requirements for Delta IV missions (all variants). The SMFCO may approve changes to this annex to accommodate operation-peculiar requirements.

2.0. Range Tracking Systems (RTS). Two adequate and independent instrumentation data sources from liftoff through flight control end of mission are MANDATORY.

2.1. Radar. Radars supporting a MANDATORY requirement must be capable of tracking in both skin and transponder modes. A radar slaving source is REQUIRED.

2.1.1. Local. One Vandenberg AFB radar with RF visibility to the launch site and ability to provide quality on-target track of either the booster or transponder no later than three (3) seconds prior to minimum time to endanger (MTE-3 sec) is MANDATORY for liftoff. Data from liftoff is REQUIRED. A second Vandenberg AFB radar is REQUIRED for liftoff. The requirement for tracking of jettisoned strap-on solid rocket motors (SRM) from release to impact will be specified in a mission specific RSOR supplement.

2.1.2. Remote. One remote radar (downrange and/or crossrange from Vandenberg AFB) is MANDATORY for liftoff for Delta IV Medium-Plus variants. A remote radar is not required for standard Delta IV Medium or Delta IV Heavy variants.

2.1.3. TNAR Filter. Not required.

2.2. Transponder. A trackable non-coherent C-band transponder on the launch vehicle is MANDATORY.

2.3. Telemetered Inertial Guidance (TMIG). One string of TMIG is MANDATORY and a second string is REQUIRED.

2.4. Global Positioning System (GPS). The use of a GPS translator or receiver shall be considered on a case-by-case basis until adequate experience has been gained to define these requirements. If flown, one string of GPS present position and IIP data is REQUIRED.

3.0. Telemetry. Receipt of telemetered data from the first FTS turn-on through flight control EOM is MANDATORY. One Vandenberg AFB TM site is MANDATORY for all Delta IV variants. One remote TM site is MANDATORY for all Delta IV Medium-Plus variants. A telemetry slaving source is REQUIRED.

4.0. Command. The capture of the CRDs from turn on through flight control EOM is MANDATORY.

4.1. Command systems. A centrally controlled command processing system is MANDATORY. Configure CCS modes as follows:

CCS Mode	Configuration
Operational	Single Non-Redundant
Support	Secure
Failure	Dual

4.2. Command transmitters. Two Vandenberg AFB command transmitters with directional and omni-directional antennas and RF visibility to the launch site are MANDATORY. The primary transmitter system must have line-of-site to the pad. Two remote transmitters (downrange and/or crossrange from Vandenberg AFB) with directional antennas are MANDATORY for Delta IV Medium-Plus variants. Remote transmitters are not required for standard Delta IV Medium or Delta IV Heavy variants. Power must be supplied to the MANDATORY command transmitters in such a way so that the loss of a single source of power will not disable both transmitters. Command transmitter site secure code capability is REQUIRED. Elevation of the directional antennas will not be less than three degrees unless directed by the MFCO. Carrier frequency is 416.5 MHz with +/- 30 kHz deviation per tone, Expanded Mode, Monitor 7. Initiate prime CCT switches from local to remote transmitter at T+70 seconds. Initiate local omni to directional antenna switch at T+75 seconds.

4.3. Command slaving source. A real-time slaving source is MANDATORY for the directional antenna at each command transmitter site prime for supporting a MANDATORY command transmitter requirement.

4.4. Command failover. Automatic failover capability connecting all supporting command transmitters is MANDATORY.

4.5. Flight termination system (FTS). A redundant launch vehicle FTS is MANDATORY.

5.0. Displays. The continuous real-time display of launch vehicle performance and system status that affects flight safety is MANDATORY.

5.1. Tracking Display. Two complete Range Safety Display Systems (RSDS) are MANDATORY. Each string will consist of one MANDATORY and one REQUIRED display for the MFCO and one MANDATORY and one REQUIRED display for the RTDC. Display markers for support aircraft, seacraft, oil platforms and unsheltered launch area personnel are REQUIRED. A mission continuation display is REQUIRED.

5.2. MFCO Stripchart Display. Two stripchart recorders are REQUIRED. MFCC stripchart recorder console lights are REQUIRED. Configure the red and green lights above each MFCC stripchart recorder such that the green lights are illuminated when the telemetry bit stream is in sync and the red lights are illuminated when the bit stream is out of sync. MFCC stripchart recorders should be configured for best source display. Configure each stripchart recorder channel for full-scale data display.

5.2.1. Chamber Pressure. Booster chamber pressure telemetry for each engine is REQUIRED. Chamber pressure channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.2. Steering. Vehicle steering (yaw, pitch, roll) is REQUIRED. Steering channel assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments.

5.2.3. Automatic Gain Control (AGC). Command Receiver Decoder (CRD) AGC levels are REQUIRED. AGC assignments are specified in Table 5.1, MFCC Stripchart Recorder Channel Assignments (Medium; Medium-Plus 4,2; Medium-Plus 5,2; Medium-Plus 5,4 & Heavy).

Table 5.1. MFCC Stripchart Recorder Channel Assignments (Medium; Medium-Plus 4,2; Medium-Plus 5,2; Medium-Plus 5,4 & Heavy).

[Delta IV Medium]

Recorder #1

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/1	Yaw Output	R
2/2	Pitch Output	R
3/3	Roll Output	R
4/4	Stage 1 Chamber Pressure	R
5/5	Stage 2 Chamber Pressure	R
6/6	(OPEN)	-
7/7	CRD #1 AGC	R
8/8	CRD #2 AGC	R
EVENT/9	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

Recorder #2

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/10	Yaw Output	R
2/11	Pitch Output	R
3/12	Roll Output	R
4/13	Stage 1 Chamber Pressure	R
5/14	Stage 2 Chamber Pressure	R
6/15	(OPEN)	-
7/16	CRD #1 AGC	R
8/17	CRD #2 AGC	R
EVENT/18	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

[Delta IV Medium-Plus 4,2 & 5,2]

Recorder #1

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/1	Yaw Output	R
2/2	Pitch Output	R
3/3	Roll Output	R
4/4	Stage 1 Chamber Pressure	R
5/5	Stage 2 Chamber Pressure	R
6/6	SRM 1 Chamber Pressure	R
7/7	SRM 2 Chamber Pressure	R
8/8	(OPEN)	-
9/9	CRD #1 AGC	R
10/10	CRD #2 AGC	R
EVENT/11	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

Recorder #2

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/12	Yaw Output	R
2/13	Pitch Output	R
3/14	Roll Output	R
4/15	Stage 1 Chamber Pressure	R
5/16	Stage 2 Chamber Pressure	R
6/17	SRM 1 Chamber Pressure	R
7/18	SRM 2 Chamber Pressure	R
8/19	(OPEN)	-
9/20	CRD #1 AGC	R
10/21	CRD #2 AGC	R
EVENT/22	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

[Delta IV Medium-Plus 5,4]

Recorder #1

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/1	Yaw Output	R
2/2	Pitch Output	R
3/3	Roll Output	R
4/4	Stage 1 Chamber Pressure	R
5/5	Stage 2 Chamber Pressure	R
6/6	SRM 1 Chamber Pressure	R
7/7	SRM 2 Chamber Pressure	R
8/8	SRM 3 Chamber Pressure	R
9/9	SRM 4 Chamber Pressure	R
10/10	(OPEN)	-
11/11	CRD #1 AGC	R
12/12	CRD #2 AGC	R
EVENT/13	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

Recorder #2

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/14	Yaw Output	R
2/15	Pitch Output	R
3/16	Roll Output	R
4/17	Stage 1 Chamber Pressure	R
5/18	Stage 2 Chamber Pressure	R
6/19	SRM 1 Chamber Pressure	R
7/20	SRM 2 Chamber Pressure	R
8/21	SRM 3 Chamber Pressure	R
9/22	SRM 4 Chamber Pressure	R
10/23	(OPEN)	-
11/24	CRD #1 AGC	R
12/25	CRD #2 AGC	R
EVENT/26	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

[Delta IV Heavy]

Recorder #1

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/1	Yaw Output	R
2/2	Pitch Output	R
3/3	Roll Output	R
4/4	CBC 1 Chamber Pressure	R
5/5	CBC 2 Chamber Pressure	R
6/6	CBC 3 Chamber Pressure	R
7/7	Stage 2 Chamber Pressure	R
8/8	(OPEN)	-
9/9	CRD #1 AGC	R
10/10	CRD #2 AGC	R
EVENT/11	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

Recorder #2

<u>Pen/Line</u>	<u>Measurement ID</u>	<u>Requirement</u>
1/12	Yaw Output	R
2/13	Pitch Output	R
3/14	Roll Output	R
4/15	CBC 1 Chamber Pressure	R
5/16	CBC 2 Chamber Pressure	R
6/17	CBC 3 Chamber Pressure	R
7/18	Stage 2 Chamber Pressure	R
8/19	(OPEN)	-
9/20	CRD #1 AGC	R
10/21	CRD #2 AGC	R
EVENT/22	Frame Sync	R
EVENT/	1 PPS Timing	R
EVENT/	Liftoff	R

5.3. FSPO Display. A real-time Range Safety telemetry display for the FSPO, capable of providing data until flight control EOM, is MANDATORY. FSPO display requirements are specified in Table 5.2, FSPO Display Locations & Requirements. RSTS FSPO console data display requirements are specified in Tables 3.3 through 3.6 at the end of this annex and are TBD. A redundant RSTS console is DESIRED.

Table 5.2. FSPO Display Locations & Requirements.

Blockhouse		RSTS Display		RSTS Stripchart		QLDA-7 W/S	
T-0	Flight	T-0	Flight	T-0	Flight	T-0	Flight
M	R	R	R	R	M	D	D

5.4. Command Status Display. A MFCO status panel is MANDATORY for each active centrally controlled command processing system.

5.5. Attitude Display. Not required.

5.6. Mission Discrete Indicators (MDIs). MDIs are REQUIRED. MDI assignments are specified in Table 5.3, Mission Discrete Indicator Assignments.

Table 5.3. Mission Discrete Indicator Assignments.

<u>Parameter</u>	<u>Display</u>	<u>Display Color</u>	<u>Requirement</u>
TM Synchronization	SYNC	Red	R
TBD	-	-	-
TBD	-	-	-
TBD	-	-	-
Stage 2 Ignition	IGN2	Green	R
Pilot Tone Monitor, Receiver 1	TONE1	Red	M/R
Pilot Tone Monitor, Receiver 2	TONE2	Red	M/R

6.0. Communications.

6.1. Voice Communications. MFCO voice communications are restricted from monitor access by agencies outside 30 SW/SE without written permission.

6.1.1. MFCO Voice Circuits. The MANDATORY and REQUIRED voice networks (nets) and voice direct lines (VDL) listed in Table 6.1, MFCO Voice Circuit Requirements, describe the voice circuit requirements at the MFCO-1 and MFCO-2 consoles. Access by all positions on the MFCO Safety Net is MANDATORY and each position will have talk and continuous monitor capability. Table 6.2, RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements, describes the voice circuit requirements at the RSTS-1 and RSTS-2 consoles.

Table 6.1. MFCO Voice Circuit Requirements

Comm Circuit	Requirement	Comm Circuit	Requirement
MFCO Safety Net	M	FSPO*	R
Countdown Net	M	RSTS FSPO*	R
CCT-1 Net	M	OSM*	R

Safety Engineering Net	R	LST*	R
Range Safety Net	R	Program*	R
CCT-2 Net	R	Back Az*	R
Emergency Net	R	ROC	R
SCMDR Conf Net	R	RCO	R
Safety Radio Net	R	ACO*	R
Weather Conf Net	R	LWO	R
MFCO-1 (at MFCO-2)*	R	DCO	R
MFCO-2 (at MFCO-1)*	R	MCS/MC	R
CMD-1*	R	SCMDR	R
CMD-2*	R	OD	R
RTDC-1*	R	SE	R
RTDC-2*	R	Command Post	R
TMO*	R	Class A Line	R

* - Indicates positions with full MFCO Safety Net access.

Table 6.2. RSTS FSPO (MFCC) & RSTS QLDA-7 Voice Circuit Requirements

Comm Circuit	RSTS FSPO	RSTS QLDA-7
MFCO Safety Net	M	D (Monitor)
Countdown Net	M	D
Safety Engineering Net	R	-
CCT-1 Net	R	-
CCT-2 Net	R	-
Weather Conf Net	R	-
S/MFCO	R	-
FSPO	R	D
RSTS FSPO	-	D
RCO	R	-
SE	R	-
Class A Line	R	D

6.1.2. Provide one MANDATORY and two REQUIRED Class A telephone lines and one telephone for the Flight Safety Analyst workstation in the MFCC. A Class A telephone line between the MFCC Toxic Analyst workstation and DC-90 is MANDATORY. Access to a secure telephone in the MFCC is REQUIRED.

6.1.3. LST Communications. The MANDATORY and REQUIRED communication circuits listed in Table 6.3, LST Fallback Communication Access Requirements, will be provided at Building 589 for all launches utilizing SLC-6. This communication capability will be available from an outdoor location at Building 589. Additionally, this communication capability will be provided within the support facility.

Table 6.3. LST Fallback Communication Access Requirements.

Comm Circuit	Requirement
MFCO Safety Net (T/M)	M
Countdown Net (M)	R
MFCO VDL	R
OSM VDL	R
ACO VDL	R
DCG VDL (Bldg 11165)	R
Class A Line	R

T = Talk capability

M = Monitor

6.1.4. ISB Communications. Range Safety Net and Countdown Net monitors are REQUIRED. A Class A administrative telephone is REQUIRED. Range countdown clock is REQUIRED. CCTV capability is REQUIRED.

6.2. Status/Alert (S&A) System. Status/Alert modules are REQUIRED at each MFCO console from the following positions: OSM, ACO, CMD-1, CMD-2, RTDC-1, RTDC-2, FSPO and RSTS FSPO.

6.3. Closed Circuit Television (CCTV). The following five (simultaneous) displays are REQUIRED on each MFCO console: Program TV, Back Az TV, Boat Plot, ADS and one long-range optic source. Available long-range optic sources may be split between each MFCO position. Best source video is REQUIRED at the ISB post.

6.4. Optics. One long-range optic source is REQUIRED. Two launch area video cameras, identified as Program and Back Az, are REQUIRED. Television van support locations for Program and Back Az are as follows:

Launch Site	Program Site	Back Az Site
SLC-6	<200° 516 ≥200° 588	<180° 588 ≥180° Honda Ridge Road ²

* - Indicates visibility to the launch pad

** - No JB exists. Position the van safely on the right shoulder of the road approximately 9/10ths of a mile up Honda Ridge Road (N34° 35' 58.5" W120° 37' 22.5") for optimal viewing of both the launch site and the microwave tower.

6.5. Missile Lift-off Signal. A positive lift-off indication is REQUIRED.

6.6. Command Communications. The data transmission link between each CCT and the central command system will consist of two MANDATORY and two REQUIRED complete and independent duplex command and status circuits as well as one MANDATORY and one REQUIRED complete and independent duplex pointing data circuits.

6.7. Range Communication.

6.7.1. All mission essential personnel located inside the Impact Limit Line (ILL) will have means to communicate with their control centers and the LST.

6.7.2. The ability to “breakaway” from a launch vehicle anomaly when directed for all supporting aircraft whose Test Support Point (TSP) lies within the ILL is MANDATORY. The ability to receive this communication is REQUIRED. If this communication capability is lost, “no-radio” (NORDO) procedures will be implemented, which shall include a return to base procedure to avoid closed airspace (impact boxes and up range hazard and caution areas).

6.8. Clocks. Visibility by all console positions within the Mission Flight Control Center (MFCC) to UTC, range countdown and pad clocks is REQUIRED.

7.0. Data Processing. The systems that process metric and telemetry data for output to MFCC displays are at the same level of decision authority as are required for the data to be displayed. Processing and transfer of weather data to MFCC systems are required at the levels of decision authority as specified in Appendix D, Delta IV Weather System and Instrumentation Support Plan.

8.0. Meteorological. Receipt of weather data is MANDATORY and/or REQUIRED, as specified in Table 8.1, Delta IV Atmospheric Data Requirements.

8.1. Local Atmospheric Data. See Table 8.1, Delta IV Atmospheric Data Requirements.

8.2. Launch Commit Criteria. The Weather Aircraft is REQUIRED. Launch will not occur if weather conditions violate MANDATORY safety constraints for natural and triggered lightning, or triboelectrification, as described in Appendix C, Range Safety Weather Launch Commit Criteria.

8.3. Post Operation. See Table 8.1, Delta IV Atmospheric Data Requirements.

9.0. Area Clearance. Clearance of all non-mission essential personnel from areas under 30 SW surveillance and control is MANDATORY.

9.1. On-shore Surface. Clearance of all non-mission essential personnel from land areas within the ILL, including the Union Pacific Railroad (UPRR) right-of-way, is MANDATORY. UPRR clearance is as follows (subject to day-of-launch real-time analysis):

Launch Site	Vehicle	Clearance Area
SLC-6	Heavy	=158° 4S-28S >158° 4S-17S
	Medium	≤168° 4S-28S >168° 4S-17S

9.2. Offshore Surface. Clearance of danger zones and hazard areas, including uprange impact areas, is MANDATORY.

9.3. Airspace. Clearance of non-mission essential aircraft from launch safety airspace is MANDATORY.

9.4. Surveillance. A surveillance helicopter is REQUIRED. The UPRR Trainmaster is REQUIRED. NAWC boat support is REQUIRED.

9.5. Recovery. Location (longitude and latitude), report of physical condition, and recovery of nozzle closures (when safe and environmentally sound) is REQUIRED.

10.0. Data Requirements. All items are REQUIRED. See Table 10.1, Data Requirements.

Table 10.1. Data Requirements.

Data Item	Title	Data	Deliver
380.00	Post Launch Analysis Of Radar Systems, Letter Report	PLARS Report	17 WD
401.00	Video Cassette Recording	Format: SVHS (DVD is DESIRED) Time: T-90 seconds - LOV Video: Composite of Program, Back Az, LA-24, Santa Ynez, Pad/MST, Vehicle on-board Audio: Ch 1 MFCO Safety Net; Ch 2 IRIG-B	3 WD
416.00	Single Channel Voice Recording	Voice-operated MFCO communications (Compact Disc)	On Request
927.00	Events Display Recording – Range Safety	MFCC MFCO Stripchart Recorders 1 & 2	30 Minutes
928.00	Events Display Recording – Flight Safety	MFCC RSTS Stripchart Recorders 1 & 2	30 Minutes

TABLE 3.2. DELTA IV RSTS FSPO STRIPCHART SETUP SHEET

FSPO-1FSPO-2

Channel No.	Description	Type	Range Low	Range High	Channel No.	Description	Type	Range Low	Range High
1					1				
2					2				
3					3				
4					4				
5					5				
6					6				
7					7				
8					8	.			
9					9	.			
10					10				
11					11				
12					12				
13					13				
14					14				
15					15				
16					16				
17					17				
18					18				
19					19				
20					20				
21					21				
22					22				
23					23				
24					24				
25					25				
26					26				
27					27				
28					28				
29					29				
30					30				
31					31				
32	TIMING	IRIG B			32	TIMING	IRIG B		

TABLE 3.3. DELTA IV RSTS DISPLAY EXAMPLE

TBD

TABLE 3.4. DELTA IV RSTS LIMITS

[illegible]

TABLE 3.5. DELTA IV RSTS LATCHING

[illegible]

TABLE 3.6. DELTA IV RSTS GREEN BOARD MEASUREMENT LIST

[illegible]

TABLE 8.1. DELTA IV ATMOSPHERIC DATA REQUIREMENTS

Assessment	Atmospheric Parameters	Development Time by 30 WS		Data Sent to FSA	FSA Analysis Complete	Requirement
1. L-1 day debris risk	T-0 forecast of wind speed and direction, 0-60,000 ft	8-5 hr prior to LRR		5 hr prior to LRR	2 hr prior to LRR	R
2. L-1 day toxic risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-10,000 ft	6-3 hr prior to LRR		3 hr prior to LRR	2 hr prior to LRR	R
3. L-1 day overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A		N/A	N/A	NR
4. RSDS display	Observed wind speed and direction, 0-60,000 ft (met input sent to ROMSSC)	T-8 to T-4:45 hr		Update complete by T-3 hr		R
5. Pre-launch debris risk	Observed wind speed and direction, 0-60,000 ft	T-8 to T-5 hr (NLT T-6 hr) T-4 to T-1:30 hr (NLT T-2:30 hr)		T-4:30 hr T-1 hr	T-3 hr T-30 min	M M
6. Pre-launch toxic risk	T-0 forecast of wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling and cloud sky coverage for 0-10,000 ft	T-5:30 to T-3:30 hr T-4:30 to T-2:30 hr T-3:30 to T-1:30 hr (all valid T-0 to T+1 hr)		T-3:30 hr T-2:30 hr T-1:30 hr	T-2:45 hr T-1:45 hr T-:45 min	R R R M
7. Pre-launch overpressure risk	T-0 forecast of wind speed, direction, humidity and temperature for 0-20,000 ft, boundary mixing layer height and observed turbulence measurements	N/A		N/A	N/A	NR
8. Liftoff toxic hazard	Same as box 6	<u>Developed</u> T-1:30 hr to T-10 min	<u>Valid</u> T-0 to T+10 min	<u>To FSA</u> T-10 min	T-2 mins	R
9. Launch delay toxic risk	Same as box 6; valid for 60 min intervals	<u>Developed</u> T-1:30 hr to T-0 T+30 min to T+1:30 hr T+1:00 to T+2:30 hr ... T+3:30 to T+4:30 hr	<u>Valid</u> T+1 to T+2 hr T+2 to T+3 hr T+3 to T+4hr ... T+5 to T+6 hr	<u>To FSA</u> T+30 min T+1:30 hr T+2:30 hr ... T+5:30 hr	30 min after receipt of data	M
10. Cat abort toxic hazard	Same as box 6; valid for 15 min intervals	<u>Developed</u> T-0 to T+10 min T+15 to T+30 min	<u>Valid</u> T+15 min to T+30 min T+30 min to T+45 min	<u>To FSA</u> T+15 min T+30 min	ASAP after Cat Abort	M
11. Re-constructed T-0 weather profile for toxic analysis	Observed wind speed, direction, pressure, humidity, temperature, inversion height, height of cloud base ceiling, cloud sky coverage and turbulence measurements for 0-10,000 ft	T-0 to T+24 hr		T+24 hr	N/A	R

APPENDIX A

LAUNCH AREA CLEARANCE/SUPPORT LOCATIONS

Launch Site	Launch Vehicle	LST Fallback	Program & TV JB	Back Az & TV JB	Nominal RR Protection
LF-02	Peacekeeper	21	85 ¹	86 ¹	3N-14N
LF-03	OSPTLV	21	85 ¹	86 ¹	3N-14N
LF-04	Minuteman III	21	13 ¹	101	3N-14N
LF-05	Peacekeeper	21	13 ¹	101	3N-14N
LF-06	OSPTLV	22	203	78 ¹	None
LF-09	Minuteman III	22	203	78 ¹	None
LF-10	Minuteman III	21	101 ¹	86 ¹	3N-14N
LF-21	GMD BV	21	13 ¹	85	3N-14N
LF-26	Minuteman III	22	89A ¹	81	None
SLC-2W	Delta II	4	FB 4 ¹	69 ¹	8N-18S
SLC-3E	Atlas II	9	539	502 ¹	Surf-32S
SLC-4E	Titan IV	9	539	<200° 506 ¹ /502 ¹ ≥200° 502 ¹	<190° Surf-31S ≥190° Surf-18S
SLC-4W	Titan II	9	539	<200° 506 ¹ /502 ¹ ≥200° 502 ¹	<190° Surf-34S ≥190° Surf-18S
SLC-6	Delta IV Heavy	B589	<200° 516 ≥200° 588	<180° 588 ≥180° HRR ²	=158° 4S-28S >158° 4S-17S
SLC-6	Delta IV Medium	B589	<200° 516 ≥200° 588	<180° 588 ≥180° HRR ²	≤168° 4S-28S >168° 4S-17S
576E	Taurus	4	OS-45 ¹	14	8N-18S
576E	OSPSLV	4	OS-45 ¹	14	8N-18S
SSI CLF	OSPSLV	B589	588	≤220° HRR ² >220° 516	4S-18S

1. Indicates visibility to the launch pad.

2. Position the van safely on the right shoulder of the road approximately 9/10ths of a mile up Honda Ridge Road (N34° 35' 58.5" W120° 37' 22.5").

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APPENDIX B

SMFCO (S-033) / MFCO (S-029) COMMUNICATIONS PANELS

1 Countdown Net - 1	2 Countdown Net - 2	3	4	5 <i>M</i>	6 <i>I</i> <i>N</i>	7 <i>S</i> <i>E</i>	8 <i>S</i> <i>T</i>	9 <i>I</i> <i>S</i> *	10 <i>O</i>	11 <i>N</i>	12
13	14	15	16	17 <i>M</i>	18 <i>I</i> <i>V</i>	19 <i>S</i> <i>D</i>	20 <i>S</i> <i>L</i>	21 <i>I</i> <i>S</i> *	22 <i>O</i>	23 <i>N</i>	24
25 MFCO Safety Net	26 Safety Radio Net	27 CCT Net - 1	28 CCT Net - 2	29 Range Safety Net	30 Weather Conf Net	31 Safety Engineering Net	32	33 SCMDR Conf	34 Command Post VDL	35 30 SW/SE VDL	36 30 SW/CC 30 OD VDL
37 Program VDL *	38 Back Az VDL *	39 LST FALLBACK VDL *	40 OSM VDL *	41 FSPO VDL *	42 RSTS FSPO VDL	43 TMO VDL	44 RTDC - 1 VDL	45 RTDC - 2 VDL	46 CMD - 1 VDL	47 CMD - 2 VDL	48 SMFCO/ MFCO VDL
49 ROC VDL	50 RCO - 1 VDL	51 ACO/DAC VDL	52 DCO VDL	53 MCS/MC VDL	54 LWO VDL	55 OD NET	56	57 USER VDL	58 LOCC VDL *	59	60
61 WB 6-4711	62 WB 6-7412	63	64	65	66 Emergency Net	67 C/A	68 C/A	69 C/A	70 C/A	71 C/A	72 C/A

* Required as per individual OD assigned by NIP.

CA Control Access area.

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APPENDIX C RANGE SAFETY WEATHER LAUNCH COMMIT CRITERIA

Natural and Triggered Lightning Launch Commit Criteria (LCC)

The Launch Weather Team must have clear and convincing evidence that the following hazard avoidance criteria are not violated.

Even when these criteria are not violated, if any other hazardous condition exists prior to terminal count, the Launch Weather Team (LWT) will report the threat to the appropriate agency. After terminal count, the Launch Weather Officer (LWO) will call a HOLD on the appropriate countdown net. At any time, the HOLD will be based upon the instability of the weather and/or loss of mandatory instrumentation.

1. **Lightning.**

- a) Do not launch for 30 minutes after any type of lightning occurs in a thunderstorm if the flight path will carry the vehicle within 10 NM of that thunderstorm.
- b) Do not launch for 30 minutes after any type of lightning occurs within 10 NM of the flight path

unless:

- (1) The cloud that produced the lightning is not within 10 NM of the flight path;

and

- (2) There is at least one working field mill within 5 NM of each such lightning flash;

and

- (3) The absolute values of all electric field measurements at the surface within 5 NM of the flight path and at the mill(s) specified in (2) above have been less than 1000 V/m for 15 minutes.

Note:

- i) Anvils are covered in Criterion 3.
- ii) If a cumulus cloud remains 30 minutes after the last lightning occurs in a thunderstorm then Criterion 2 applies.

Definitions: Anvil, Electric Field Measurement at the Surface, Flight Path, Thunderstorm, Within

2. Cumulus Clouds.

- a) Do not launch if the flight path will carry the vehicle within 10 NM of any cumulus cloud with its cloud top higher than the -20 deg C level.
- b) Do not launch if the flight path will carry the vehicle within 5 NM of any cumulus cloud with its cloud top higher than the -10 deg C level.
- c) Do not launch if the flight path will carry the vehicle through any cumulus cloud with its cloud top higher than the -5 deg C level.
- d) Do not launch if the flight path will carry the vehicle through any cumulus cloud with its cloud top between the +5 deg C and -5 deg C levels

unless:

- (1) The cloud is not producing precipitation;

and

- (2) The horizontal distance from the center of the cloud top to at least one working field mill is less than 2 NM;

and

- (3) All electric field measurements at the surface within 5 NM of the flight path and at the mill(s) specified in (2) above have been between -100 V/m and +500 V/m for 15 minutes.

Note: Cumulus clouds in Criterion 2 do not include altocumulus, cirrocumulus or stratocumulus.

Definitions: Cloud Top, Electric Field Measurement at the Surface, Flight Path, Precipitation,
Within

3. Anvil Clouds.

- a) Attached Anvils:
 - (1) Do not launch if the flight path will carry the vehicle through nontransparent parts of attached anvil clouds.
 - (2) Do not launch if the flight path will carry the vehicle within 5 NM of nontransparent parts of attached anvil clouds for the first 3 hours after the time of the last lightning discharge that occurs in the parent cloud or anvil cloud.
 - (3) Do not launch if the flight path will carry the vehicle within 10 NM of

nontransparent parts of attached anvil clouds for the first 30 minutes after the time of the last lightning discharge that occurs in the parent cloud or anvil cloud.

b) Detached Anvils:

- (1) Do not launch if the flight path will carry the vehicle through nontransparent parts of a detached anvil cloud for the first 3 hours after the time that the anvil cloud is observed to have detached from the parent cloud.
- (2) Do not launch if the flight path will carry the vehicle through nontransparent parts of a detached anvil cloud for the first 4 hours after the time of the last lightning discharge that occurs in the detached anvil cloud.
- (3) Do not launch if the flight path will carry the vehicle within 5 NM of nontransparent parts of a detached anvil cloud for the first 3 hours after the time of the last lightning discharge that occurs in the parent cloud or anvil cloud before detachment or in the detached anvil cloud after detachment

unless

- (a) There is at least one working field mill within 5 NM of the detached anvil cloud;

and

- (b) The absolute values of all electric field measurements at the surface within 5 NM of the flight path and at the mill(s) specified in (a) above have been less than 1000 V/m for 15 minutes;

and

- (c) The maximum radar return from any part of the detached anvil cloud within 5 NM of the flight path has been less than 10 dBZ for 15 minutes.

- (4) Do not launch if the flight path will carry the vehicle within 10 NM of nontransparent parts of a detached anvil cloud for the first 30 minutes after the time of the last lightning discharge that occurs in the parent cloud or anvil cloud before detachment or in the detached anvil cloud after detachment.

Note: Detached anvil clouds are never considered *debris clouds*, nor are they covered by Criterion 4.

Definitions: Anvil, Debris Cloud, Flight Path, Thunderstorm, Within

4. Debris Clouds.

- a) Do not launch if the flight path will carry the vehicle through any nontransparent parts of a debris cloud during the 3-hour period defined below.
- b) Do not launch if the flight path will carry the vehicle within 5 NM of any nontransparent parts of a debris cloud during the 3-hour period defined below,

unless
 - (1) There is at least one working field mill within 5 NM of the debris cloud;

and
 - (2) The absolute values of all electric field measurements at the surface within 5 NM of the flight path and at the mill(s) specified in (1) above have been less than 1000 V/m for 15 minutes;

and
 - (3) The maximum radar return from any part of the debris cloud within 5 NM of the flight path has been less than 10 dBZ for 15 minutes.

The 3-hour period in a) and b) above begins at the time when the debris cloud is observed to have detached from the parent cloud or when the debris cloud is observed to have formed from the decay of the parent cloud top below the altitude of the -10 deg C level. The 3-hour period begins anew at the time of any lightning discharge that occurs in the debris cloud.

Definitions: Cloud Top, Debris Cloud, Electric Field Measurement at the Surface, Flight Path, Nontransparent, Within

5. Disturbed Weather.

Do not launch if the flight path will carry the vehicle through any nontransparent clouds that are associated with a weather disturbance having clouds that extend to altitudes at or above the 0 deg C level and contain moderate or greater precipitation or a radar bright band or other evidence of melting precipitation within 5 NM of the flight path.

Definitions: Associated, Flight Path, Nontransparent, Weather Disturbance, Within, Moderate Precipitation

6. Thick Cloud Layers.

Do not launch if the flight path will carry the vehicle through nontransparent parts of a cloud layer that is:

- (1) Greater than 4,500 ft thick and any part of the cloud layer along the flight path is located between the 0 deg C and the -20 deg C levels;

or

- (2) Connected to a cloud layer that, within 5 NM of the flight path, is greater than 4,500 ft thick and has any part located between the 0 deg C and the -20 deg C levels;

unless the cloud layer is a cirriform cloud that has never been associated with convective clouds, is located entirely at temperatures of -15 deg C or colder, and shows no evidence of containing liquid water (e.g. aircraft icing).

Definitions: Associated, Cloud Layer, Flight Path, Nontransparent

7. Smoke Plumes.

Do not launch if the flight path will carry the vehicle through any cumulus cloud that has developed from a smoke plume while the cloud is attached to the smoke plume, or for the first 60 minutes after the cumulus cloud is observed to have detached from the smoke plume.

Note: Cumulus clouds that have formed above a fire but have been detached from the smoke plume for more than 60 minutes are considered *cumulus clouds* and are covered in Criterion 2.

Definitions: Flight Path

8. Surface Electric Fields.

- a) Do not launch for 15 minutes after the absolute value of any electric field measurement at the surface within 5 NM of the flight path has been greater than 1500 V/m.
- b) Do not launch for 15 minutes after the absolute value of any electric field measurement at the surface within 5 NM of the flight path has been greater than 1000 V/m

unless:

- (1) All clouds within 10 NM of the flight path are transparent;

or

- (2) All nontransparent clouds within 10 NM of the flight path have cloud tops below the +5 deg C level and have not been part of convective clouds with cloud tops above the -10 deg C level within the last 3 hours.

Notes:

- i) Electric field measurements at the surface are used to increase safety by detecting electric fields due to unforeseen or unrecognized hazards
- ii) For confirmed failure of one or more field mill sensors, the countdown and launch may continue.

Definitions: Cloud Top, Electric Field Measurement at the Surface, Flight Path, Nontransparent, Transparent, Within

9. Electric Fields Aloft.

Criteria 3, 4, 5, 6, 7, and 8(b) need not be applied if, during the 15 minutes prior to launch time, the instantaneous electric field aloft, throughout the volume of air expected to be along the flight path, does not exceed E_c , where E_c is shown as a function of altitude in Figure 9-1.

Definitions: Flight Path, Electric Field Measurement Aloft

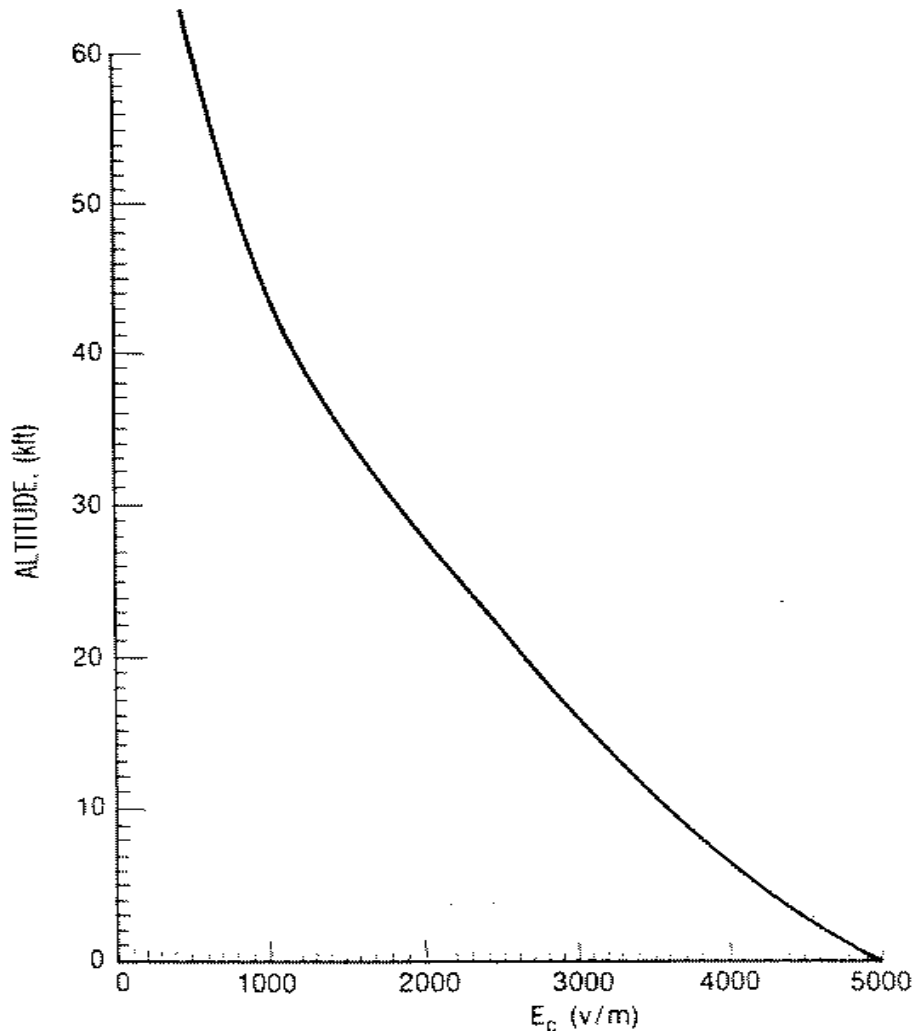


Figure 9-1 Instantaneous Critical Electric Field, E_c , vs. Altitude

Note: The thresholds on electric field measurements at the surface in Criterion 8 and elsewhere in these LCC are lower than 5 kV/m to allow for the effect of the surface screening layer.

10. Triboelectrification.

Do not launch if a vehicle has not been treated for surface electrification and the flight path will go through any clouds above the -10 deg C level up to the altitude at which the vehicle's velocity exceeds 3000 ft/sec.

Note: A vehicle is considered “treated” for surface electrification if:

- a) All surfaces of the vehicle susceptible to precipitation particle impact have been treated to assure:
 - (1) That the surface resistivity is less than 10^9 ohms/square;
 - and
 - (2) That all conductors on surfaces (including dielectric surfaces that have been treated with conductive coatings) are bonded to the vehicle by a resistance that is less than 10^5 ohms;
- or
- b) It has been shown by test or analysis that electrostatic discharges (ESD) on the surface of the vehicle caused by triboelectrification by precipitation particle impact will not be hazardous to the launch vehicle or the mission.

Definitions: Flight Path

11. Definitions.

Anvil: Stratiform or fibrous cloud produced by the upper level outflow or blow-off from thunderstorms or convective clouds.

Associated: Used to denote that two or more clouds are causally related to the same weather disturbance or are physically connected. *Associated* is not synonymous with occurring at the same time. An example of clouds that are *not* associated is air mass clouds formed by surface heating in the absence of organized lifting. Also, a cumulus cloud formed locally and a physically separated cirrus layer generated by a distant source are not associated, even if they occur over or near the launch site at the same time.

Subsidiary Definition: Weather Disturbance.

Bright Band: An enhancement of radar reflectivity caused by frozen hydrometeors falling through the 0 deg C level and beginning to melt.

Cloud Edge: The visible cloud edge is preferred. If this is not possible, then the 10 dBZ radar reflectivity cloud edge is acceptable.

Cloud Layer: A vertically continuous array of clouds, not necessarily of the same type, whose bases

are approximately at the same level.

Cloud Top: The visible cloud top is preferred. If this is not possible, then the 10 dBZ radar reflectivity cloud top is acceptable.

Cumulonimbus Cloud: Any convective cloud with any part above the -20 deg C temperature level.

Debris Cloud: Any cloud, except an anvil cloud, that has become detached from a parent cumulonimbus cloud or thunderstorm, or that results from the decay of a parent cumulonimbus cloud or thunderstorm.

Subsidiary Definition: Cumulonimbus Cloud

Electric Field Measurement Aloft: The magnitude of the instantaneous, vector, electric field (**E**) at a known position in the atmosphere, such as measured by a suitably instrumented, calibrated, and located airborne-field-mill aircraft.

Electric Field Measurement at the Surface: The one-minute arithmetic average of the vertical electric field (**E_z**) at the ground measured by a ground based field mill. The polarity of the electric field is the same as that of the potential gradient; that is, the polarity of the field at the ground is the same as the dominant charge overhead.

Note: Electric field contours shall not be used for the electric field measurement at the surface.

Flight Path: The planned flight path including its uncertainties (“error bounds”).

Moderate Precipitation : A precipitation rate of 0.1 inches/hr or a radar reflectivity factor of 30 dBZ.

Nontransparent: Opposite of Transparent. Sky cover through which forms are blurred, indistinct, or obscured is nontransparent.

Note: Nontransparency must be assessed for launch time. Sky cover through which forms are seen distinctly *only* through breaks in the cloud cover is considered nontransparent. Clouds with a radar reflectivity of 10 dBZ or greater are also considered nontransparent.

Subsidiary Definition: Transparent

Optically Thin: Having a vertical optical thickness of unity or less at visible wavelengths.

Precipitation: Detectable rain, snow, sleet, etc. at the ground, or virga, or a radar reflectivity greater than 18 dBZ.

Transparent: Synonymous with optically thin. Sky cover is transparent if higher clouds, blue sky, stars, the disk of the sun, etc. can be distinctly seen from below, or if the sun casts distinct shadows of objects on the ground, or if terrain, buildings, lights on the ground, etc., can be distinctly seen from above.

Note: Visible transparency is required. Transparency must be assessed for launch time. Sky cover through which forms are seen distinctly *only* through breaks in the cloud cover is considered *nontransparent*.

Subsidiary Definitions: Nontransparent, Optically Thin

Thunderstorm: Any convective cloud that produces lightning

Weather Disturbance: A weather system where dynamical processes destabilize the air on a scale larger than the individual clouds or cells. Examples of disturbances are fronts, troughs and squall lines.

Within: Used as a function word to specify a margin in all directions (horizontal, vertical, and slant separation) between the cloud edge or top and the flight path. For example, “*within* 10 NM of a thunderstorm cloud” means that there must be a 10 NM margin between every part of a thunderstorm cloud and the flight path.

Subsidiary Definitions: Cloud Edge, Cloud Top, Flight Path

12. CONCURRENCE.

We want the record to show that we believe the best way to ensure safety from atmospheric electricity hazards, and also to improve launch availability, is to use an instrumented aircraft in conjunction with a ground-based field mill network to measure the electric field environment and its time development along and near the flight path. This recommendation has previously been made in the H. A. Heritage Report titled "Launch Vehicle Lightning/Atmospheric Electrical Constraints Post-Atlas/Centaur '67 Incident," in the National Academy of Science Panel Report titled "Meteorological Support for Space Operations," and in our August 1992 recommendations made at the Marshall Space Flight Center.

Signed

Dr. Harry C. Koons
Distinguished Scientist
Space and Environment Technology Center
The Aerospace Corporation

Signed

Dr. Richard L. Walterscheid
Senior Scientist
Space and Environment Technology Center
The Aerospace Corporation

Signed

Dr. E. Philip Krider
Professor and Chair, Lightning Advisory
Panel
Institute of Atmospheric Physics
University of Arizona

Signed

Dr. John C. Willett
Physicist
Air Force Research Laboratory

Signed

Dr. W. David Rust
Chief, Mesoscale Research and Applications
Division
National Severe Storms Laboratory

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APPENDIX D

**PEACEKEEPER
WEATHER SYSTEM AND INSTRUMENTATION SUPPORT PLAN**

SYSTEM/ INSTRUMENT	SAFETY	ASSIGNMENT	BACKUP
Weather Aircraft	R	Natural Lightning Thunderstorm Avoidance Cumulus Avoidance Layered Cloud Assessment Disturbed Weather Debris and Anvil Avoidance Smoke Cloud Avoidance	Consider Area Clearance Aircraft and 76 HF Helicopters. Use satellite, NEXRAD, balloon data, and weather observers.
AMPS 1&2	M/R	Upper Air Profiles Low Resolution / High Resolution Upper level wind speed/shear Safety: REEDM, LARA	None.
CDAPS	R	Tower Network (temperature, wind, dewpoint) REEDM surface wind	BU-CDAPS
Tower 60	R	REEDM surface wind Launch Drift Winds	None.
Tower 17	R	REEDM surface wind Launch Drift Winds	None.
NLDN	R	Cloud to Ground Lightning	None.
NEXRAD (WSR-88D)	R	Cumulus Avoidance Thunderstorm Avoidance Disturbed Weather	Wx Aircraft. LAX or MRY dial in (depending on upstream direction and operation).
DC-94 AWIPS	R	Satellite Imagery, Forecast Models	AWDS, NIPRNET, Wx Aircraft.
DC-95 MIDDS-V	R	Wind Tower Data	CDAPS Printer
RTAMPS 1&2	M/R	Balloon Data Editing Low Resolution / High Resolution Upper level wind speed/shear	None.
ASOS LF03	R	REEDM Clouds/Visibility	Observation airfield
DASS LF-03	R	REEDM	Balloons, Towers, other DASS (Bldg 1764)

MINUTEMAN III
WEATHER SYSTEM AND INSTRUMENTATION SUPPORT PLAN

SYSTEM/ INSTRUMENT	SAFETY	ASSIGNMENT	BACKUP
Weather Aircraft	R	Natural Lightning Thunderstorm Avoidance Cumulus Avoidance Layered Cloud Assessment Disturbed Weather Debris and Anvil Avoidance Smoke Cloud Avoidance	Consider Area Clearance Aircraft and 76 HF Helicopters. Use satellite, NEXRAD, balloon data, and weather observers.
AMPS 1&2	M/R	Upper Air Profiles Low Resolution / High Resolution Upper level wind speed/shear Safety: REEDM, LARA	None.
CDAPS	R	Tower Network (temperature, wind, dewpoint) REEDM surface wind	BU-CDAPS
Tower 60	R	REEDM surface wind	None.
Tower 17	R	REEDM surface wind	None.
NLDN	R	Cloud to Ground Lightning	None.
NEXRAD (WSR-88D)	R	Cumulus Avoidance Thunderstorm Avoidance Disturbed Weather	Wx Aircraft. LAX or MRY dial in (depending on upstream direction and operation).
DC-94 AWIPS	R	Satellite Imagery, Forecast Models	AWDS, NIPRNET, Wx Aircraft.
DC-95 MIDS-V	R	Wind Tower Data	CDAPS Printer
RTAMPS 1&2	M/R	Balloon Data Editing Low Resolution / High Resolution Upper level wind speed/shear	None.
ASOS LF03	R	REEDM Clouds/Visibility	Observations Airfield
DASS LF-03	R	REEDM	Balloons, Towers, other DASS (Bldg 1764)

**ORBITAL SUBORBITAL PROGRAM TARGET LAUNCH VEHICLE
WEATHER SYSTEM AND INSTRUMENTATION SUPPORT PLAN**

SYSTEM/ INSTRUMENT	SAFETY	ASSIGNMENT	BACKUP
Weather Aircraft	R	Natural Lightning Thunderstorm Avoidance Cumulus Avoidance Layered Cloud Assessment Disturbed Weather Debris and Anvil Avoidance Smoke Cloud Avoidance	Consider Area Clearance Aircraft and 76 HF Helicopters. Use satellite, NEXRAD, balloon data, and weather observers.
AMPS 1&2	M/R	Upper Air Profiles Low Resolution / High Resolution Upper level wind speed/shear Safety: REEDM, LARA User: Loads, CR, Wind speed/shear	None.
CDAPS	R	Tower Network (temperature, wind, dewpoint) REEDM surface wind Shelter Roll-back	BU-CDAPS
Tower 60	R	REEDM surface wind Shelter Roll-back	
Tower 17	R	REEDM surface wind Shelter Roll-back	Tower 60
NLDN	R	Cloud to Ground Lightning	None.
NEXRAD (WSR-88D)	R	Cumulus Avoidance Thunderstorm Avoidance Disturbed Weather	Wx Aircraft. LAX or MRY dial in (depending on upstream direction and operation).
DC-94 AWIPS	R	Satellite Imagery, Forecast Models	AWDS, NIPRNET, Wx Aircraft.
DC-95 MIDDs-V	R	Launch Drift Winds MST Roll Winds Vehicle Exposure Wind & Temp	CDAPS Printer
RTAMPS 1&2	M/R	Balloon Data Editing Low Resolution / High Resolution Upper level wind speed/shear	None.
ASOS LF-03	R	REEDM Clouds/Visibility	Observations Airfield
DASS LF-03	R	REEDM	Balloons, Towers, other DASS (Bldg 1764)

**GROUND-BASED MIDCOURSE DEFENSE
BOOSTER VERIFICATION
WEATHER SYSTEM AND INSTRUMENTATION SUPPORT PLAN**

SYSTEM/ INSTRUMENT	SAFETY	ASSIGNMENT	BACKUP
Weather Aircraft	R	Natural Lightning Thunderstorm Avoidance Cumulus Avoidance Layered Cloud Assessment Disturbed Weather Debris and Anvil Avoidance Smoke Cloud Avoidance	Consider Area Clearance Aircraft and 76 HF Helicopters. Use satellite, NEXRAD, balloon data, and weather observers.
AMPS 1&2	M/R	Upper Air Profiles Low Resolution / High Resolution Upper level wind speed/shear Safety: REEDM, LARA User: Loads, CR, Wind speed/shear	None.
CDAPS	R	Tower Network (temperature, wind, dewpoint) REEDM surface wind Shelter Roll-back	BU-CDAPS
Tower 60	R	REEDM surface wind Shelter Roll-back	
Tower 17	R	REEDM surface wind Shelter Roll-back	Tower 60
NLDN	R	Cloud to Ground Lightning	None.
NEXRAD (WSR-88D)	R	Cumulus Avoidance Thunderstorm Avoidance Disturbed Weather	Wx Aircraft. LAX or MRY dial in (depending on upstream direction and operation).
DC-94 AWIPS	R	Satellite Imagery, Forecast Models	AWDS, NIPRNET, Wx Aircraft.
DC-95 MIDDS-V	R	Launch Drift Winds Tower Roll Winds	CDAPS Printer
RTAMPS 1&2	M/R	Balloon Data Editing Low Resolution / High Resolution Upper level wind speed/shear	None.
ASOS LF-03	R	REEDM Clouds/Visibility	Observations Airfield
DASS LF-03	R	REEDM	Balloons, Towers, other DASS (Bldg 1764)

ATLAS IIAS
WEATHER SYSTEM AND INSTRUMENTATION SUPPORT PLAN

SYSTEM/ INSTRUMENT	SAFETY	ASSIGNMENT	BACKUP
Weather Aircraft	R	Natural Lightning Thunderstorm Avoidance Cumulus Avoidance Layered Cloud Assessment Disturbed Weather Debris and Anvil Avoidance Smoke Cloud Avoidance	Consider Area Clearance Aircraft and 76 HF Helicopters. Use satellite, NEXRAD, balloon data, and weather observers.
AMPS 1&2	M/R	Upper Air Profiles Low Resolution / High Resolution Upper level wind speed/shear Safety: REEDM, LARA User: Loads, CR, Wind speed/shear	None.
CDAPS	R	Tower Network (temperature, wind, dewpoint) Launch Drift Winds MST Roll Winds Vehicle Exposure Wind and Temp	BU-CDAPS RLCC (Bldg 8510) has live <u>wind</u> display panel directly from Tower 54 (1 second data).
Tower 54	R	Launch Drift Winds MST Roll Winds Vehicle Exposure Wind and Temp	Other height levels. None.
NLDN	R	Cloud to Ground Lightning	None.
NEXRAD (WSR-88D)	R	Cumulus Avoidance Thunderstorm Avoidance Disturbed Weather	Wx Aircraft. LAX or MRY dial in (depending on upstream direction and operation).
DC-94 AWIPS	R	Satellite Imagery, Forecast Models	AWDS, NIPRNET, Wx Aircraft.
DC-95 MIDDSS-V	R	Launch Drift Winds MST Roll Winds Vehicle Exposure Wind & Temp	CDAPS Printer
RTAMPS 1&2	M/R	Balloon Data Editing Low Resolution / High Resolution Upper level wind speed/shear	None.
DC-98/99 MARSSS 1&2	R	THZs Monitoring Surface Winds for Resource Protection (radars)	DoD Pamphlet. MIDDSS-V, CDAPS Printer.
DASS Bldg 1764	R	REEDM	Balloons, Towers, other DASS (LF-03)
ASOS SLC-4	R	Surface Observation	None

DELTA II
WEATHER SYSTEM AND INSTRUMENTATION SUPPORT PLAN

SYSTEM/ INSTRUMENT	SAFETY	ASSIGNMENT	BACKUP
Weather Aircraft	R	Natural Lightning Thunderstorm Avoidance Cumulus Avoidance Layered Cloud Assessment Disturbed Weather Debris and Anvil Avoidance Smoke Cloud Avoidance Precipitation above 10,000' Precipitation below 10,000'	Consider Area Clearance Aircraft and 76 HF Helicopters. Use satellite, NEXRAD, balloon data, and weather observers.
AMPS 1&2	M/R	Upper Air Profiles Low Resolution / High Resolution Upper level wind speed/shear Safety: REEDM, LARA User: Loads, CR, Wind speed/shear	None.
CDAPS	R	Tower Network (temperature, wind, dewpoint) Launch Drift Winds MST Roll Winds Vehicle Exposure Wind & Temp	BU-CDAPS RLCC (Bldg 8510) has live <u>wind</u> display panel directly from Tower 102 (1 second data).
Tower 102	R	Launch Drift Winds MST Roll Winds Vehicle Exposure Wind & Temp	None. PRAWS Near 576E.
NLDN	R	Cloud to Ground Lightning	None.
NEXRAD (WSR-88D)	R	Cumulus Avoidance Thunderstorm Avoidance Disturbed Weather Precipitation Above 10,000' Precipitation Below 10,000' Exhaust Cloud Imagery	Wx Aircraft. LAX or MRY dial in (depending on upstream direction and operation).
DC-94 AWIPS	R	Satellite Imagery, Forecast Models	AWDS, NIPRNET, Wx Aircraft.
DC-95 MIDDS-V	R	Launch Drift Winds MST Roll Winds Vehicle Exposure Wind & Temp	CDAPS Printer
RTAMPS 1&2	M/R	Balloon Data Editing Low Resolution / High Resolution Upper level wind speed/shear	None.
DC-98/99 MARSSS 1&2	R	THZs Monitoring Surface Winds for Resource Protection (radars)	DoD Pamphlet. MIDDS-V, CDAPS Printer.
DASS Bldg 1764	R	REEDM	Balloons, Towers, other DASS (LF-03, Bldg 900)

TITAN II
WEATHER SYSTEM AND INSTRUMENTATION SUPPORT PLAN

SYSTEM/ INSTRUMENT	SAFETY	ASSIGNMENT	BACKUP
Weather Aircraft	R	Natural Lightning Thunderstorm Avoidance Cumulus Avoidance Layered Cloud Assessment Disturbed Weather Debris and Anvil Avoidance Smoke Cloud Avoidance Virga Avoidance at or above 4000'	Consider Area Clearance Aircraft and 76 HF Helicopters. Use satellite, NEXRAD, balloon data, and weather observers.
AMPS 1&2	M/R	Upper Air Profiles Low Resolution / High Resolution Upper level wind speed/shear Safety: REEDM, LARA User: Loads, CR, Wind speed/shear	None.
CDAPS	R	Tower Network (temperature, wind, dewpoint) Launch Drift Winds MST Roll Winds Vehicle Exposure Wind	BU-CDAPS RLCC (Bldg 8510) has live <u>wind</u> display panel directly from Tower 300 (1 second data).
Tower 300	R	Launch Drift Winds MST Roll Winds Vehicle Exposure Wind	Other height levels. None.
NLDN	R	Cloud to Ground Lightning	None.
NEXRAD (WSR-88D)	R	Cumulus Avoidance Thunderstorm Avoidance Disturbed Weather Virga Avoidance at or above 4000'	Wx Aircraft. LAX or MRY dial in (depending on upstream direction and operation).
DC-94 AWIPS	R	Satellite Imagery, Forecast Models	AWDS, NIPRNET, Wx Aircraft.
DC-95 MIDDS-V	R	Launch Drift Winds MST Roll Winds Vehicle Exposure Wind & Temp	CDAPS Printer
RTAMPS 1&2	M/R	Balloon Data Editing Low Resolution / High Resolution Upper level wind speed/shear	None.
DC-98/99 MARSSS 1&2	R	THZs Monitoring Surface Winds for Resource Protection (radars)	DoD Pamphlet. MIDDS-V, CDAPS Printer.
DASS Bldg 1764	R	REEDM	Balloons, Towers, other DASS (LF-03)
ASOS SLC-4	R	Surface Observation	None

TITAN IV
WEATHER SYSTEM AND INSTRUMENTATION SUPPORT PLAN

SYSTEM/ INSTRUMENT	SAFETY	ASSIGNMENT	BACKUP
Weather Aircraft	R	Natural Lightning Thunderstorm Avoidance Cumulus Avoidance Layered Cloud Assessment Disturbed Weather Debris and Anvil Avoidance Smoke Cloud Avoidance Virga Avoidance at or above 4000'	Consider Area Clearance Aircraft and 76 HF Helicopters. Use satellite, NEXRAD, balloon data, and weather observers.
AMPS 1&2	M/R	Upper Air Profiles Low Resolution / High Resolution Upper level wind speed/shear Safety: REEDM, LARA User: Loads, CR, Wind speed/shear	None.
CDAPS	R	Tower Network (temperature, wind, dewpoint) Launch Drift Winds MST Roll Winds Vehicle Exposure Wind & Temp	BU-CDAPS RLCC (Bldg 8510) has live <u>wind</u> display panel directly from Tower 300 (1 second data).
Tower 300	R	Launch Drift Winds MST Roll Winds Vehicle Exposure Wind & Temp	Other height levels. None.
NLDN	R	Cloud to Ground Lightning	None.
NEXRAD (WSR-88D)	R	Cumulus Avoidance Thunderstorm Avoidance Disturbed Weather Virga Avoidance at or above 4000' Exhaust Cloud Imagery	Wx Aircraft. LAX or MRY dial in (depending on upstream direction and operation).
DC-94 AWIPS	R	Satellite Imagery, Forecast Models	AWDS, NIPRNET, Wx Aircraft.
DC-95 MIDDS-V	R	Launch Drift Winds MST Roll Winds Vehicle Exposure Wind & Temp	CDAPS Printer
RTAMPS 1&2	M/R	Balloon Data Editing Low Resolution / High Resolution Upper level wind speed/shear	None.
DC-98/99 MARSSS 1&2	R	THZs Monitoring Surface Winds for Resource Protection (radars)	DoD Pamphlet. MIDDS-V, CDAPS Printer.
DASS Bldg 1764	R	REEDM	Balloons, Towers, DASS LF-03.
ASOS SLC-4	R	Surface Observation	None

PEGASUS
WEATHER SYSTEM AND INSTRUMENTATION SUPPORT PLAN

SYSTEM/ INSTRUMENT	SAFETY	ASSIGNMENT	BACKUP
Weather Aircraft	R	Natural Lightning Thunderstorm Avoidance Cumulus Avoidance Layered Cloud Assessment Disturbed Weather Debris and Anvil Avoidance Smoke Cloud Avoidance Precipitation along flight path	Consider Chase Aircraft, Area Clearance Aircraft and 76 HF Helicopters. L-1011 pilot can also evaluate enroute. Use satellite, NEXRAD, balloon data, and weather observers.
AMPS 1&2	M/R	Upper Air Profiles Low Resolution / High Resolution Upper level wind speed/shear Safety: REEDM, LARA User: Loads, CR, Wind speed/shear	None.
NLDN	R	Cloud to Ground Lightning	None.
NEXRAD (WSR-88D)	R	Cumulus Avoidance Thunderstorm Avoidance Disturbed Weather Precipitation Along Flight Path	Wx Aircraft/Chase Plane MRY dial in (depending on upstream direction and operation).
DC-94 AWIPS	R	Satellite Imagery, Forecast Models	AWDS, NIPRNET, Wx Aircraft.
RTAMPS 1&2	M/R	Balloon Data Editing Low Resolution / High Resolution Upper level wind speed/shear	None.

TAURUS
WEATHER SYSTEM AND INSTRUMENTATION SUPPORT PLAN

SYSTEM/ INSTRUMENT	SAFETY	ASSIGNMENT	BACKUP
Weather Aircraft	R	Natural Lightning Thunderstorm Avoidance Cumulus Avoidance Layered Cloud Assessment Disturbed Weather Debris and Anvil Avoidance Smoke Cloud Avoidance Precipitation above 2,000'	Consider Area Clearance Aircraft and 76 HF Helicopters. Use satellite, NEXRAD, balloon data, and weather observers.
AMPS 1&2	M/R	Upper Air Profiles Low Resolution / High Resolution Upper level wind speed/shear Safety: REEDM, LARA User: Loads, CR, Wind speed/shear	None.
CDAPS	R	Tower Network (temperature, wind, dewpoint) Launch Drift Winds Vehicle Exposure Wind Bucket Truck Operations	BU-CDAPS
Tower 102	R	Launch Drift Winds Vehicle Exposure Wind Bucket Truck Operations	None. PRAWS Near 576E.
NLDN	R	Cloud to Ground Lightning	None.
NEXRAD (WSR-88D)	R	Cumulus Avoidance Thunderstorm Avoidance Disturbed Weather Precipitation Above 2,000'	Wx Aircraft. LAX or MRY dial in (depending on upstream direction and operation).
DC-94 AWIPS	R	Satellite Imagery, Forecast Models	AWDS, NIPRNET, Wx Aircraft.
DC-95 MIDDS-V	R	Launch Drift Winds MST Roll Winds Vehicle Exposure Wind & Temp	CDAPS Printer
RTAMPS 1&2	M/R	Balloon Data Editing Low Resolution / High Resolution Upper level wind speed/shear	None.
DC-98/99 MARSSS 1&2	R	THZs Monitoring Surface Winds for Resource Protection (radars)	DoD Pamphlet. MIDDS-V, CDAPS Printer.
DASS Bldg 1764	R	REEDM	Balloons, Towers, other DASS (LF-03)

**ORBITAL SUBORBITAL PROGRAM SPACE LAUNCH VEHICLE
WEATHER SYSTEM AND INSTRUMENTATION SUPPORT PLAN**

SYSTEM/ INSTRUMENT	SAFETY	ASSIGNMENT	BACKUP
Weather Aircraft	R	Natural Lightning Thunderstorm Avoidance Cumulus Avoidance Layered Cloud Assessment Disturbed Weather Debris and Anvil Avoidance Smoke Cloud Avoidance	Consider Area Clearance Aircraft and 76 HF Helicopters. Use satellite, NEXRAD, balloon data, and weather observers.
AMPS 1&2	M/R	Upper Air Profiles Low Resolution / High Resolution Upper level wind speed/shear Safety: REEDM, LARA User: Loads, CR, Wind speed/shear	None.
CDAPS	R	Tower Network (temperature, wind, dewpoint) Launch Drift Winds MST Roll Winds Vehicle Exposure Wind & Temp	BU-CDAPS RLCC (Bldg 8510) has live <u>wind</u> display panel directly from Tower 301 (1 second data).
Tower 301	R	Launch Drift Winds MST Roll Winds Vehicle Exposure Wind & Temp	Other height levels. None.
NLDN	R	Cloud to Ground Lightning	None.
NEXRAD (WSR-88D)	R	Cumulus Avoidance Thunderstorm Avoidance Disturbed Weather	Wx Aircraft. LAX or MRY dial in (depending on upstream direction and operation).
DC-94 AWIPS	R	Satellite Imagery, Forecast Models Optic site cloud	AWDS, NIPRNET, Wx Aircraft.
DC-95 MIDDS-V	R	Launch Drift Winds MST Roll Winds Vehicle Exposure Wind & Temp	CDAPS Printer
RTAMPS 1&2	M/R	Balloon Data Editing Low Resolution / High Resolution Upper level wind speed/shear	None.
DC-98/99 MARSSS 1&2	R	THZs Monitoring Surface Winds for Resource Protection (radars)	DoD Pamphlet. MIDDS-V, CDAPS Printer.
DASS Bldg 1764	R	REEDM	Balloons, Towers DASS LF-03

DELTA IV
WEATHER SYSTEM AND INSTRUMENTATION SUPPORT PLAN

SYSTEM/ INSTRUMENT	SAFETY	ASSIGNMENT	BACKUP
Weather Aircraft	R	Natural Lightning Thunderstorm Avoidance Cumulus Avoidance Layered Cloud Assessment Disturbed Weather Debris and Anvil Avoidance Smoke Cloud Avoidance	Consider Area Clearance Aircraft and 76 HF Helicopters. Use satellite, NEXRAD, balloon data, and weather observers.
AMPS 1&2	M/R	Upper Air Profiles Low Resolution / High Resolution Upper level wind speed/shear Safety: REEDM, LARA User: Loads, CR, Wind speed/shear	None.
CDAPS	R	Tower Network (temperature, wind, dewpoint) Launch Drift Winds MST Roll Winds Vehicle Exposure Wind & Temp	BU-CDAPS RLCC (Bldg 8510) has live <u>wind</u> display panel directly from Tower 300 (1 second data).
Tower 301	R	Launch Drift Winds MST Roll Winds Vehicle Exposure Wind & Temp	Other height levels. None.
NLDN	R	Cloud to Ground Lightning	None.
NEXRAD (WSR-88D)	R	Cumulus Avoidance Thunderstorm Avoidance Disturbed Weather Virga Avoidance at or above 4000' Exhaust Cloud Imagery	Wx Aircraft. LAX or MRY dial in (depending on upstream direction and operation).
DC-94 AWIPS	R	Satellite Imagery, Forecast Models	AWDS, NIPRNET, Wx Aircraft.
DC-95 MIDDS-V	R	Launch Drift Winds MST Roll Winds Vehicle Exposure Wind & Temp	CDAPS Printer
RTAMPS 1&2	M/R	Balloon Data Editing Low Resolution / High Resolution Upper level wind speed/shear	None.
DC-98/99 MARSSS 1&2	R	THZs Monitoring Surface Winds for Resource Protection (radars)	DoD Pamphlet. MIDDS-V, CDAPS Printer.
DASS Bldg 1764	R	REEDM	Balloons, Towers, DASS LF-03.
ASOS SLC-4	R	Surface Observation	None

APPENDIX E

FLIGHT SAFETY PROJECT OFFICER (FSPO) DISPLAYS

The following is a summary of FSPO data display locations and requirements:

Program	Blockhouse		RSTS Display		RSTS Stripchart		QLDA-7 W/S	
	T-0	Flight	T-0	Flight	T-0	Flight	T-0	Flight
Peacekeeper	R	N/C	R	R	M	M	D	D
MM3	M	N/C	R	R	M	M	D	D
OSPTLV	M	R	R	R	R	M	D	D
BVT	M	R	LCB	LCB	R	M	D	D
Atlas II	M	R	R	R	R	M	D	D
Delta II	M	R	R	R	R	M	D	D
Titan II	M	N/C	R	R	R	M	D	D
Titan IV	M	D	R	R	R	M	D	D
Pegasus	R	R	R	R	M	M	D	D
Taurus	M	R	R	R	R	M	D	D
OSPSLV	M	R	R	R	R	M	D	D
Delta IV	M	R	R	R	R	M	D	D

Codes:

M – Mandatory

R – Required

D – Desired

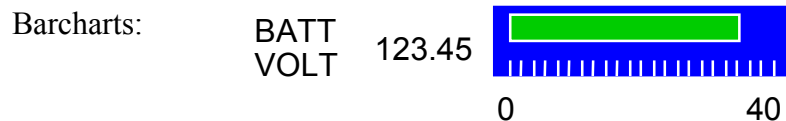
LCB – Limited Commitment Basis

ETB – Engineering Test Basis

N/R – No Requirement

N/C – No Capability

Graphic icons are used to display the required measurement data on the FSPO RSTS displays. Following is a description of the icons and their intended behavior.



Barcharts are used to present the data in a graphical manner. The color of the barchart segments should indicate the condition of the measurement as it relates to the critical limits. Green shall

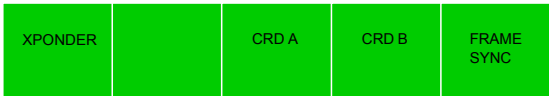
represent when the measurement is within nominal value, yellow shall indicate when the measurement exceeds the nominal value but has not reached the non-operating threshold, and red shall indicate that the measurement has exceeded the critical limit. Adjacent to the bar chart is a tabular representation of the real time measurement, its color should also change to reflect the measurement status. The bar chart scale shall reflect the minimum and maximum data values.

Tabular Data box: AGC DBM 

Tabular data boxes are used to represent the measurement data in tabular format. The color of the text shall indicate the status of the measurement as it relates to the critical limits. The measurement ID is located in the data box to facilitate construction of the display only. The actual display will contain the measurement value.

Status button: DEST 

Status buttons will be used to display discrete type measurements. The color of the button will identify which state the measurement is in, the text will identify the measurement state. The color of the button (red, amber, or green) shall indicate whether the measurement is in favorable condition or not.

Green board: 

The individual green status buttons at the bottom of the display shall indicate the combined measurement status of the applicable area.

Colors:

The color scheme shall take into consideration the contrast between data and background. Green shall be used to denote a within tolerance measurement or condition. Yellow shall be used to caution the operator that the measurement is beyond the bounds of nominal but not exceeding the maximum variance from nominal. Red shall be used to alert the operator that the measurement has exceeded tolerance or is not acceptable to the predetermined rules. Items that are not used shall be grayed out.

Latches:

The discrete indicators shall remain latched to the failure condition until reset by the operator. This reset may be a mouse or keyboard input that acknowledges the condition, resets the indicator, and returns to real time monitoring. Bar chart tabular data shall latch when an out of tolerance condition exist, however, the bar chart itself should remain a real time monitor. Reset of the condition shall be performed by mouse click or keyboard input.

APPENDIX F
MISSION SPECIFIC RSOR SUPPLEMENTS

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